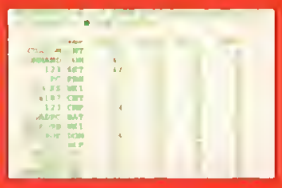
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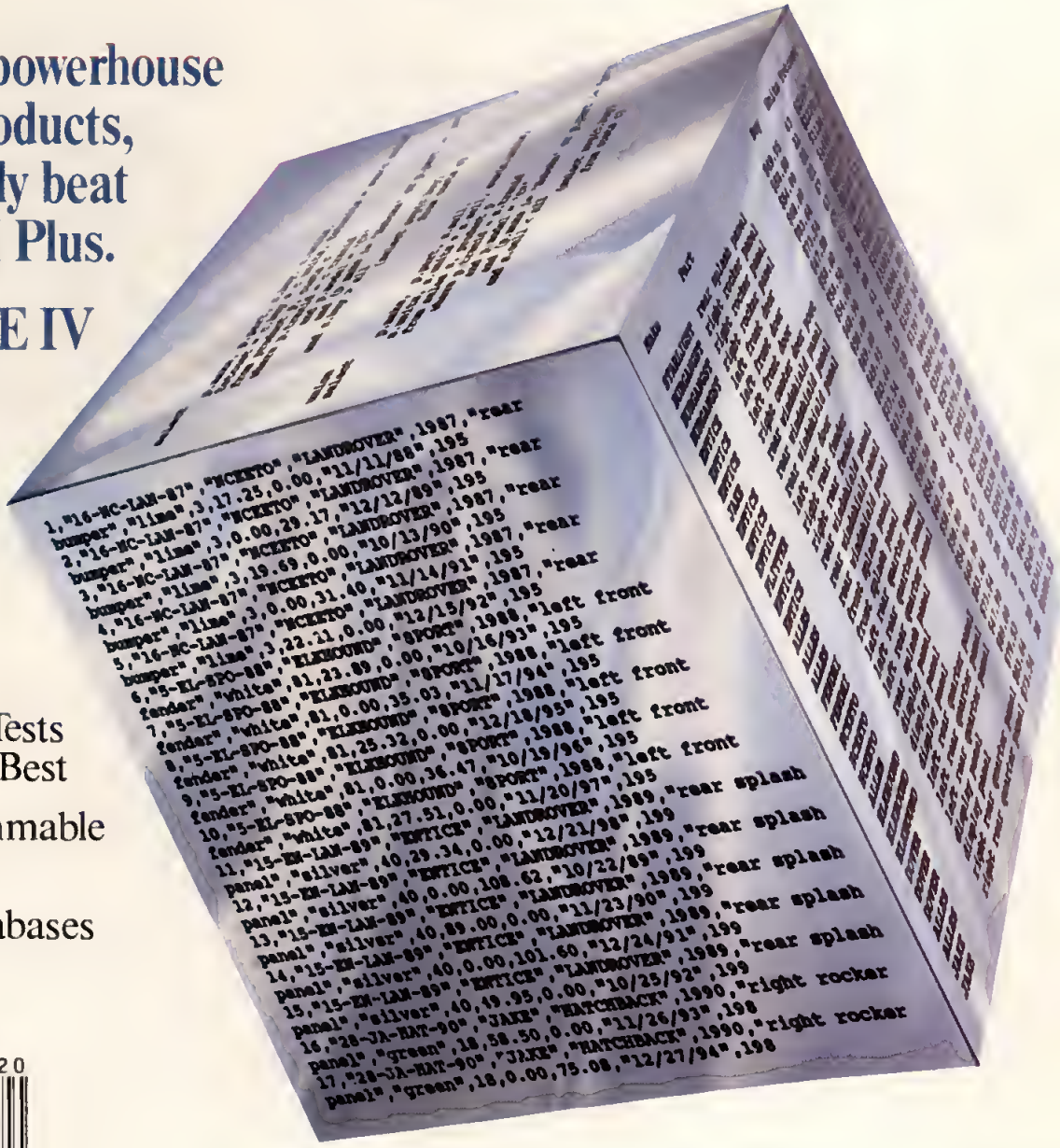
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VOLUME 7 NUMBER 9
MAY 17, 1988

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VOLUME 7 NUMBER 9

WHAT'S INSIDE

This issue marks the completion of *PC Magazine*'s three-part Project Database blockbuster, the first comprehensive look we've taken at this product category in almost 2 years. This time around we've tested and evaluated 43 programmable databases—including 5 SQL-based packages—bringing the grand total of DBMSs we've reviewed for this tripartite roundup to 76.



Still crazy after all these databases: PC Labs project leader Bill O'Brien headed this year's three-part database project.

This installment of Project Database 3 focuses on the most sophisticated and full-featured data managers on the market. All have their own procedural or nonprocedural languages, some offer near-seamless applications portability with mainframe and minicomputer systems, and others feature a cache of productivity-boosting tools and utilities as well as interfaces to standard high-level programming languages such as C and Pascal. As Jim Seymour points out in his introduction, "Programmable Databases: dBASE and Its Challengers," it's a group as diverse as it is powerful, with products cutting across three database architectures: network, hierarchical (with data arranged in parent-child order), and relational.

Of special interest in this issue is Richard Hale Shaw's review of the best-known and most widely used PC-based DBMS, Ashton-Tate's *dBASE III Plus*, and his preview of the soon-to-be-released *dBASE IV*. Although *dBASE III Plus* is virtually synonymous with programmable databases for most PC users—and its history virtually a parable of the allegiances of the high-end DBMS market—this product has seen increased competition in the last 2 years and is also showing signs of age. Three packages bested it in the Editor's Choice competition. But as Shaw suggests in *PC Magazine*'s first feature-length look at *dBASE IV*, this package promises to pick up in a big way where *dBASE III Plus* leaves off.

As varied as these programmable databases are, five out of the group share an important characteristic that may play a deciding role in the future of PC database technology: Structured Query Language (SQL). In his article "SQL: An Emerging Database Standard for PCs," *dBASE* reviewer Shaw discusses the relationship between SQL and the relational model and the benefits to PC users of working with a DBMS that combines the two.

Just as it does for all the large-scale projects that *PC Magazine* undertakes, PC Labs developed a suite of benchmark tests to identify the fastest packages. Overseeing the testing was Bill O'Brien, a PC Labs project leader, who underwent an endurance test of his own, having served as project leader for all three database issues.

Photograph: Thom O'Connor

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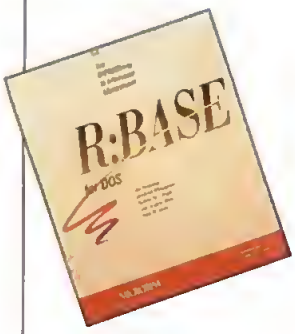
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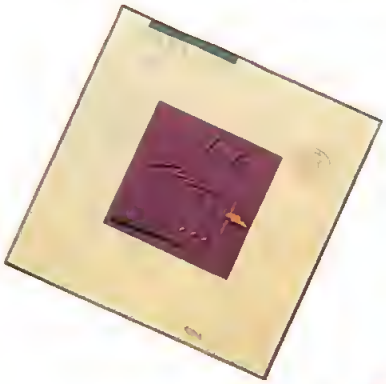
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PROJECT DATABASE 3

Programmable Databases: dBASE and Its Challengers

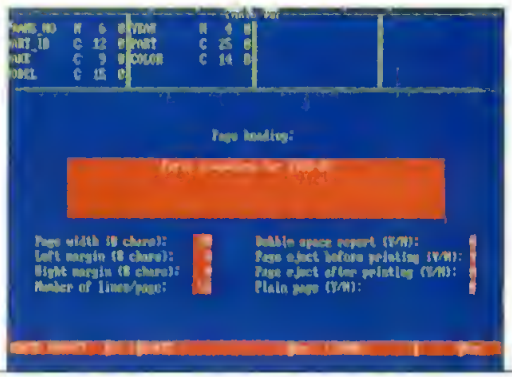
Jim Seymour/ Ashton-Tate's *dBASE* set the standard for programmable database managers and now, with the soon-to-be-released *dBASE IV*, is trying to top its own act. Other companies are attempting to grab a share of the market, some by imitating *dBASE*, others by approaching database design in different ways. Here you'll find reviews, a features table, and benchmark tests for 38 hierarchical, network, and relational DBMSs in the final chapter of our three-issue database blockbuster.....93







***FoxBase Plus* is a powerful, fast *dBASE* replacement.**



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SQL: An Emerging Database Standard for PCs

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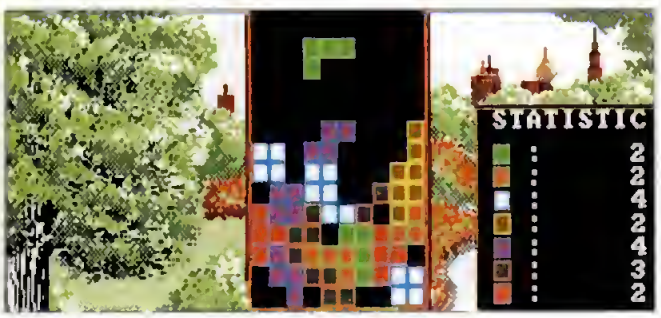
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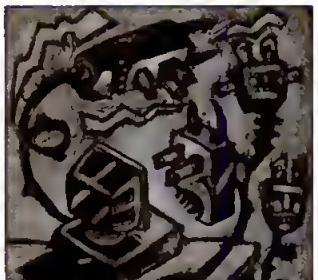
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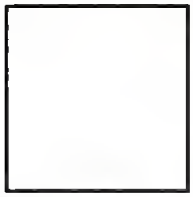
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"The 12-MHz Breakthru 286-12 speedup board is the fastest of those tested, but not the most expensive. On a dollar per-horsepower basis, it could be called the cheapest boost available for an XT."
Mark Welch, InfoWorld **(Rated #1)**

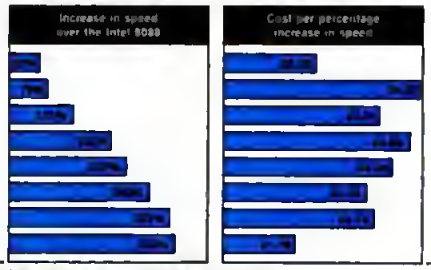
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Accelerator Cards: Speed and Value

Speed figures are consolidated results from 10 tests of CPU performance (See Accelerator Boards Special Report, December 1, 1986.)

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☐ Microsoft Mach 10	$395
☐ Univation Dream Board	$512
☐ Orchid Turbo EGA	$945
☐ ST&D Standard 286	$995
☐ Classic Speedpack	$995
☐ Orchid PC-Turbo 286e	$1,195
☐ **Breakthru 286-12**	**$595**



REPRINTED FROM INFOWORLD, APRIL 27, 1987

Breakthru 286-8MHz-$395
Breakthru 286-12MHz-$595

LIGHTNING™—FREE with Breakthru speedup hardware—$89.95 purchased separately

We are excited about our three speedup products. You probably know about our Lightning disk access speedup software that was awarded PC Magazine's Best of 1986 award (see box). After the smashing success of Lightning, in late '86, we guaranteed the Breakthru 286 board to be literally the most advanced, fastest, most feature-rich board available. The runaway success it has enjoyed truly proved that assertion. Now we go ourselves one better with the Breakthru 286-12. This new board has the clock speed cranked up from 8 to 12 MHz for speeds up to 10.2 times faster than an IBM PC. It is 50% faster than an 8MHz IBM AT, and up to a whopping 1,000% faster than a regular PC.

HERE'S WHY THESE TWO BOARDS ARE SO SPECIAL.

First, they install so easily. A half-slot card means you don't even have to give up a full slot. What's more, unlike competing products it works in the Compaq Portable and most clones. Easy diagrams show how you just place the card in an open slot, remove the original processor and connect a single cable. There is no software required. From that moment you are running faster than an AT.

Second, they are advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. Has a 80287 math coprocessor slot for numeric intensive applications. A 16K cache memory provides zero-wait-access to the most recently used code and data. Speed switching software allows you to drop back to a lower speed on the fly for timing sensitive applications.

Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Faster and smarter than an AT - PCSG guarantees it.

Fourth, these are the best. There are several other boards on the speedup market. We at PCSG have compared them all, but there simply is no comparison. Many cards offer only a marginal speedup in spite of their claims and others are just poorly engineered.

We are really excited about these products. PCSG makes the unabashed statement that the BREAKTHRU 286 card represents more advanced technology than boards by Orchid, Quadram, P.C. Technologies, Phoenix...we could go on. Breakthru 286 is undisputedly the turbo board with the biggest bang for the buck. And we include FREE the $89.95 acclaimed Lightning software. Call today with your credit card or COD instructions and we will ship your card the very next day.

But, no speedup board cuts disk access time in half

LIGHTNING

software can - $89.95 or FREE w/Breakthru

"Lightning is almost mandatory...." -
Steve Manes, PC Magazine
Best of 86 review

Loads with the DOS - always ready as a background program to accelerate disk access. You do nothing - everything is automatic. Programs that frequently access the disk (hard or floppy) are made instantly up to 2 to 4 times faster. Uses a principle greatly enhanced from mainframe technology called caching. Fully exploits Above Board memory.

LIGHTNING is the standard against which all our competition measures itself because we achieve universal compatibility with other software. Data is never lost. Order ***LIGHTNING*** separately or get it free with your Breakthru 286 board.

PC MAGAZINE BEST OF 1986



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Lucid 3-D is priced to sell at $199, but we want thousands of people using Lucid everyday, all over the world. We invite you to be a part of that group. The reason we are offering Lucid for only $149, on a sixty day return for a full refund, is simple. Preliminary user testing of the product produces the same results over and over. People tell us they would never work without Lucid 3-D again. Even folks continuing to work with 1-2-3.

Memory Resident

That's because the idea of a memory resident spreadsheet makes sense, one that you can pop-up instantly while working in your word processor or any other program. Lucid lets you cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Lucid 3-D was developed over the past two years with countless, exhaustive hours of planning and programming to produce something spectacular. This is a product that works the way we dreamed a spreadsheet would function. Everyone who has seen it says things like, "*Lucid 3-D is how software of the 1990's will look and perform*", or even more to the point "*This is the way I thought a computer should work*". You'll see, Lucid is exciting.





FIG. 2 Here we are, instantly. Notice the lower left corner showing we are on level 2. You can go down or up. (See next page)

FIG. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (grey +).

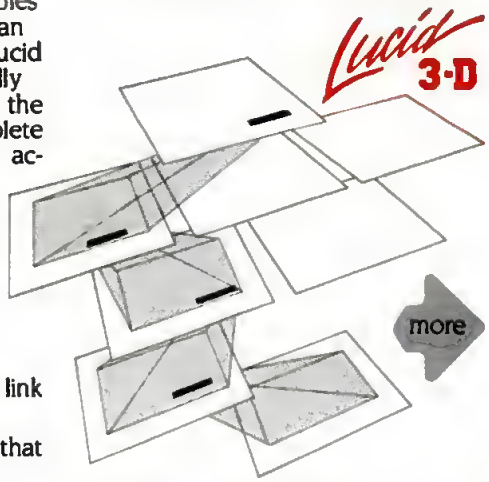
way. Users say "*It is so intuitive that I really don't need a manual.*" That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "*If there ever was an interface idea so good it ought to be stolen and widely used, this is it.*"

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recognize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.

What Makes it so Special

In the screen examples you can see Lucid is really multi-dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that. All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that



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Any cell can contain a complete other spreadsheet that you can access with a single key.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 400 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.



FIG. 3 We want more detail, so let's go to Newspapers. Just press the Grey + Key



FIG. 4. Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

> "The best idea I've seen for a spreadsheet in years."
>
> Jim Seymour, Columnist, PC Magazine, PC Week

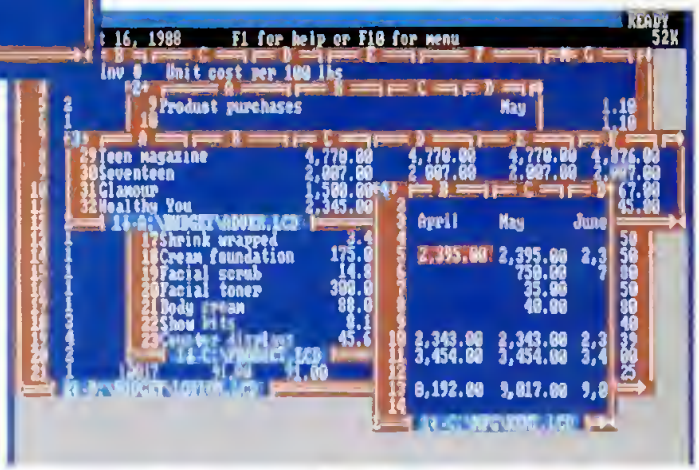


Fig. 5. Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many as 3-D levels as you like. No one else can do that.

Speed

Lucid 3-D is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D also lets you teach it any combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes, Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

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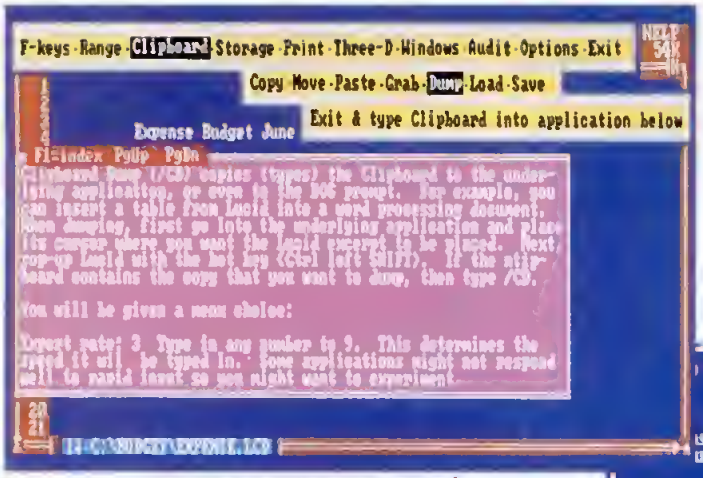


FIG. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.



FIG. 7 Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid offers five audit displays and printouts.

Masterwork

We could go on at great length about all the features and innovations in Lucid, but Lucid is more than a bag of features. What is most important is the pride and craftsmanship that went into its creation. It is a masterwork. The overall feel is tight and polished. In fact, Paul Somerson, executive editor of PC *Magazine*, used one word to describe it, "*Slick*".

PCSG has built a reputation as a development laboratory producing products that you know are excellent. In 1983 PCSG dominated the Model 100 laptop market with ROM based software that every reviewer rated as excellent. In 1985 we produced ***LIGHTNING*** the pioneer and award winning Disk speed up software. In 1986 we developed the ***BREAKthru 286*** accelerator board that blew everything else out of the water, and later we topped ourselves with the Breakthru 12. Now in 1987 those who have worked with Lucid 3-D tell us "*you have done it again. This is software everyone should have.*"

Even if you don't plan to abandon 1-2-3. Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D without having to upset your present systems.

We are excited about Lucid 3-D. But don't take our word for it, take us up on our 60 day offer. Call us on our order line number and we will ship your order the very next day. This $149 offer will end as soon as our dealer network is fully stocked. But in the mean time we invite you to try Lucid as part of our "spread the news" campaign. Just pick up the phone and call us. We accept all major credit cards or you can order COD.

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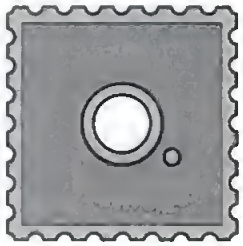
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LETTERS TO PC MAGAZINE



CHEAP ATs

How disappointed we were after reading Alfred Poor's review of the Logix ATC 286 ("The Cheapest ATs Ever," *PC Magazine*, February 16, 1988). Suggesting to your readers that the Logix AT is "different" and should be avoided is doing them a disservice.

During the past few years, we have purchased a number of Logix Microcomputer's XTs and ATs and have found their quality and compatibility to be unsurpassed. We use them both as standalone units and as workstations for our 3Com LAN. We have also found Logix's dedication and interest in its customers and products to be a rare find in today's marketplace. In fact, we are so pleased with the products and service that we are selling six of our 2-year-old brand-name PCs and replacing them with Logix ATs!

Rick Gutlon
Westport, Connecticut

After plowing through your lengthy review of low-priced ATs ("The Cheapest ATs Ever"), I have decided to buy none of the above. After countless hours of finding the causes and cures for problems encountered with my first XT clone, I'll pay the extra freight and stick with a computer company that sets standards (Compaq), rather than one that tries (often in vain) to copy them.

Stephen A. Risik
York, Pennsylvania

Contrary to Christopher Barr's review, the PC's Limited 286-8 does support 3½-inch disk drives—I have been running a 3½-inch drive on my 286-8 for almost a year ("The Cheapest ATs Ever"). A little program called Fix-AT, provided free with the Sony drive I purchased, makes the BIOS correction at boot-up.

However, it is important to note that I no longer need to use Fix-AT, as the new BIOS I purchased from Dell Computer has full 3½-inch drive support in addition to support for OS/2. Obviously, the machine Mr. Barr tested had an older BIOS.



The BIOS upgrade provided by Dell Computer exemplifies a strong ability to service its customer base. The upgrade kit, priced at a reasonable $149.95, includes a new 101-key enhanced keyboard, the keyboard chip, two new ROM BIOS chips, a chip puller, and documentation. Installing the new keyboard and BIOS took me all of 10 minutes.

I believe Mr. Barr did a slight disservice in dissuading your readers from purchasing what I have found to be a terrific PC—backed up by some very capable people.

Gregory Borchert
St. Charles, Illinois

Your article on AT compatibles ("The Cheapest ATs Ever") alerted me to possible OS/2 and 3½-inch-drive incompatibilities with my PC's Limited 286-8 machine.

After reading the article, I spoke with several service representatives at Dell Computer and asked them how they intended to take care of their old 286-8 customers. They told me since I purchased my machine before November 1987, I was not eligible for a free upgrade. I also talked to the service manager, who told me if I purchase a 3½-inch drive from Dell Computer, it would provide the ROM upgrade at no charge. However, if I purchase a drive from another company, I would have to pay for the upgrade.

I am very disappointed in Dell Computer. I think it should supply the ROM upgrade without conditions. Thank you for alerting me to these problems with the PC's Limited machines. Your article saved me some headaches—since I was just about to purchase a 3½-inch drive.

Scott Shaffar
La Verne, California

We received the PC's Limited 286-8 on October 3, 1987. The BIOS was dated May 1987. At the time, Dell Computer acknowledged the 286-8 would not support 3½-inch drives or OS/2, but it informed us a new BIOS was in the works that would correct the problems. However, at PC Magazine *we write about what we have, not about what the manufacturer says will be coming out.*

Dell Computer did send us the ROM BIOS update in November, after the feature story had been completed. And yes, the upgraded BIOS does indeed support both 3½-inch drives and OS/2. It's interesting to note that the System 200 series, the line that replaces the older 286 line, will contain a Phoenix BIOS, not a PC's Limited one.—Ed.

Your review of mail-order ATs ("The Cheapest ATs Ever") has vindicated my decision to purchase a name-brand computer from a local authorized dealer.

Before making my decision to buy locally, I called some of the mail-order companies. All but one had little time for my questions; if I wasn't going to place an or-

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PC-5/17/88

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- ☐ **EDUCATION 3**—PC-Fastype 1.20 typing tutor, ideal for beginners and advanced students alike.
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- 2 **INFO 2a,b**—(2 disks) Zip-Phone, national areacode/prefix to zip-code cross reference.
- 2 **LANGUAGE 3a,b**—(2 disks) The A86 3.09 macro assembler and debugger for 8088/86/286s.
- 2 **SHELL 4a,b**—(2 disks) Automenu and HDM II 4.04 hard disk prog. for custom full-screen menus.
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CIRCLE 302 ON READER SERVICE CARD

■ LETTERS

der then and there, they didn't want to be bothered. Comparing my new computer with the mail-order stuff you reviewed, I realize I probably didn't get the biggest performance bang for the buck. But what I did get was a well-made, well-documented machine that came from the dealer ready to run. I also have the support of a nationally known company and a reputable local dealer. As a first-time computer owner, that's certainly worth a few extra dollars to me.

Fred Grosby
Falls Church, Virginia

A NEAT REMINDER

Regarding Stephen Manes's column "Neatness: It Really Does Count" (*PC Magazine*, January 12, 1988):

Before you get too excited about full computer screens making a word processor "neat," let me remind you that legal secretaries are seldom "sweet, young things," and a preponderance are apt to be wearing bifocals. The last thing I (as a legal secretary who also operates a word processing service) want is a full screen that would require me to crane my neck painfully for 7 to 8 hours a day. Perhaps an attorney reading over his secretary's shoulder would welcome a full screen showing the document in all its hideous entirety, but have a little consideration for the poor secretary.

Programmers and technical people seem to be making the judgments on word processing programs. What we need are secretaries who actually use these programs full-time to judge them. So please don't forget the hapless wearers of bifocals when considering whether hardware is "neat" for word processing.

Glenna M. Bird
Charleston, South Carolina

LASERJET TIP

Having purchased an HP LaserJet Series II recently, I found Caroline Halliday's article "Learning to Live with Laser Printers, Part 1" to be both timely and informative (PC Lab Notes, *PC Magazine*, February 16, 1988). For those readers who want a comprehensive reference manual for the LaserJet II, there is one titled *LaserJet Series II Printer Technical Reference Manual*, available from HP dealers for $28.95. Its HP document number is 33440-90905. Though it is a reference manual, it also contains numerous examples and is well organized and comprehensive. I am certain other readers who use the LaserJet II will benefit from it.

Benjamin J. Myers
Harvard, Massachusetts

OFF-CYCLE

John C. Dvorak is always amusing, but reading his column is a disposable entertainment at best. In the February 16 issue, he claims the sunspot cycle is 22 years ("The New Age of Chaos," *PC Magazine*, February 16, 1988). In fact, the solar cycle is about 11 years, and that is only an average. Leaving aside measurement problems that obscure the precise beginning date, sunspot cycles have ranged from 8 to 13 years in duration over the more than 200 years of reliable data available.

Readers can assume that Mr. Dvorak knows more about computer industry cycles than sunspot cycles. Or at least, we better hope so.

Fred Heutte
Portland, Oregon

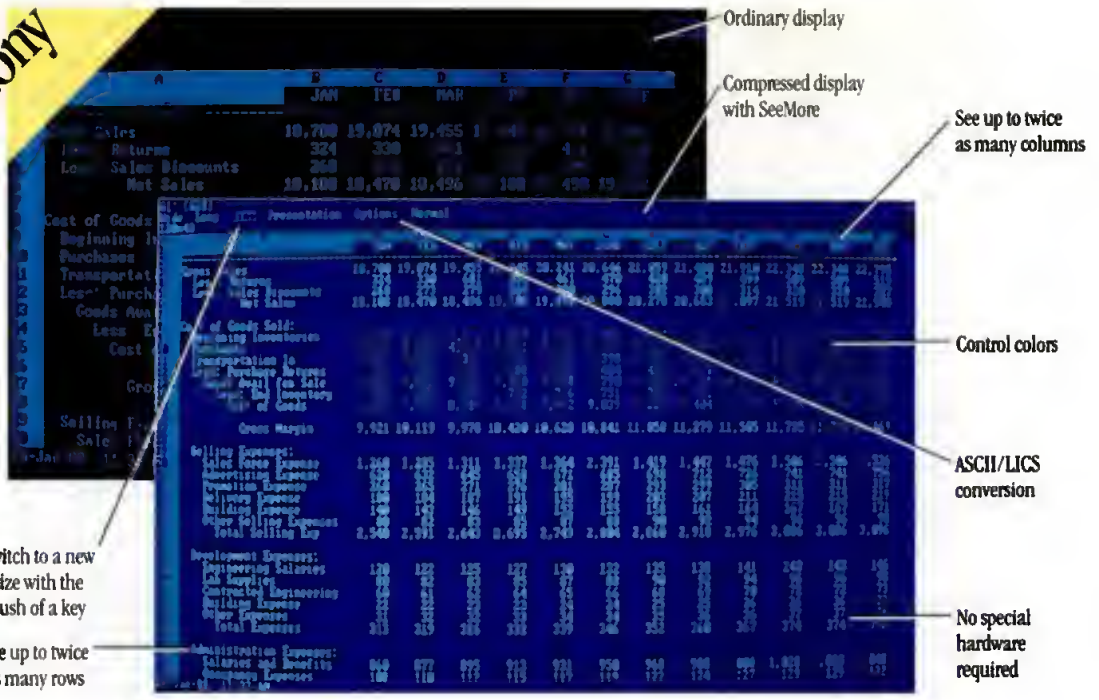
CALCULATOR CLARIFICATION

Although I have seen many uses for batch files, I have never encountered anything quite like Martin Rayrole's free calculator in User-to-User (*PC Magazine*, February 16, 1988). It does work like a charm, but I'm not sure why. Although I checked several references, I am confused by the use of the semicolon (;) and colon (:) and am uncertain how SYSTEM and FIND "=" are used in the piping sequence. A clarification of this interesting batch file would be much appreciated.

John C. Adelmann
Stratford, Connecticut

The semicolon is optional; this technique will work just fine without it. The colon lets you combine several lines of BASIC code into one; as used here the first code line (with the %1 %2 etc. replaceable parameters) does the calculation and is followed by a colon and a separate SYSTEM command that returns the operation back to DOS. And the FIND "=" filters out all the extraneous screen clutter. This batch

For 1-2-3 and Symphony



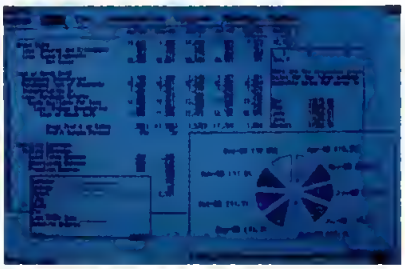
THE BEST OF 1987 PC MAGAZINE

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CIRCLE 282 ON READER SERVICE CARD



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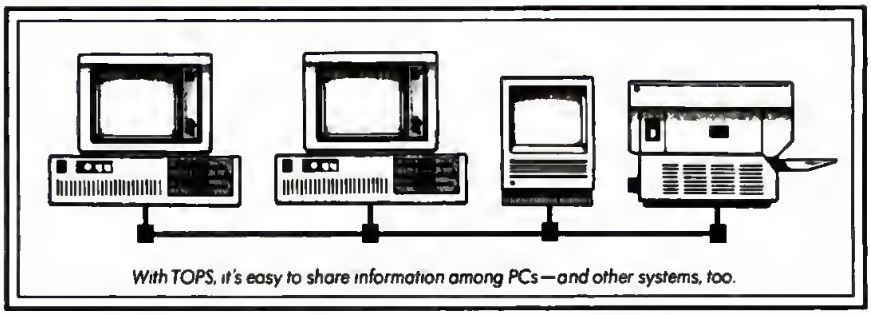
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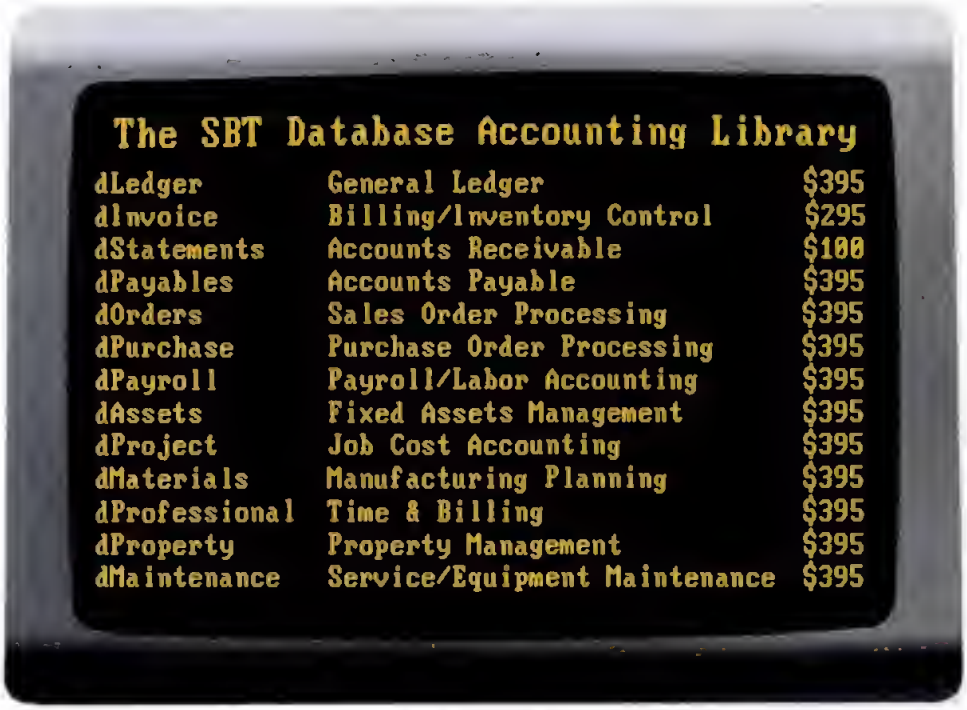
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CIRCLE 470 ON READER SERVICE CARD

■ LETTERS

file lets you do things like perform hex math or find the cosine or ASCII equivalent of a number with a few simple keystrokes.—Ed.

AT OUR SERVICE

At last! A popular magazine takes special note of the concerns of scientists ("Serving the Scientist," *PC Magazine*, February 16, 1988)! I hope Bill Machrone's viewpoint spreads, because the needs of scientists can translate into increased power and flexibility for other PC users (as is happening now with CAD software). And for me, a mathematician, it can mean easier-to-use, quality software.

William A. McWorter, Jr.
Columbus, Ohio

Hats off to Bill Machrone for his article in the February 16 issue ("Serving the Scientist")! I now have the LQ-850, which was mentioned in the article, and am utterly happy with it. I don't have the answers to all the questions posed by Bill Joyce, but I have yet to find a capability I wanted that the LQ-850 couldn't handle. As your editors at *PC Magazine* are well aware, *XyWrite* provides near perfection in printer and keyboard control, and the combination is unbeatable.

Bob Stephan
Pebble Beach, California

As a scientist, I share Bill Joyce's concerns regarding the suitability of word processors and other software for technical purposes ("Serving the Scientist"). Fortunately, because of the sheer volume of software that is reviewed in *PC Magazine*, we do get occasional reviews of technically oriented programs. But of course, the more the merrier.

Neil L. Roeth
Madison, Wisconsin

I especially enjoyed the February 16 issue of *PC Magazine*. The slight nod toward the use of computers for scientists—as evidenced by Bill Machrone's editorial ("Serving the Scientist") and the review of calculator emulator programs ("Keyboard Calculations for the PC," *PC Magazine*, February 16, 1988)—was a pleasant change.

David L. Alexander
Wappingers Falls, New York

■ The slight nod toward the use of computers for scientists, as evidenced by Bill Machrone's editorial "Serving the Scientist," was a pleasant change.

NIT-PICKIN'

We'uns down here are just plain ole country boys, but we have to set you city slickers straight. In his review of stock market programs (After Hours, *PC Magazine*, February 16, 1988), Donald B. Trivette makes a great big goof. What he should have said was "he who sells what ain't hizzen must buy it back or go to prison." Just figured you'uns needed some help now an' agin.

Glenn Ralston
Jacksonville, Florida

CORRECTIONS/AMPLIFICATIONS

The Logix ATC 286 ("The Cheapest ATs Ever," *PC Magazine*, February 16, 1988) has four available disk drive bays, putting its expansion potential on a par with many other AT compatibles.

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10 BIG REASONS IT'S TIME YOU CHANGED YOUR EDITOR TO BRIEF

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2 OUR ENTHUSIASM. While we do not publish BRIEF we wish we did. We sell so many BRIEFs that we've been advertising it non-stop since it was introduced two years ago. We're not alone in our enthusiasm. There is no end of accolades from other admirers:

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BRIEF lets you edit an *unlimited* number of files (even to the point of letting you type b ★.★ on the command line). Because of a unique virtual memory scheme, *each file* can be up to 32 million bytes large. Yet BRIEF *never* creates a "swap file," so editing a huge file is almost as fast as editing a tiny one!

What's more, you can work on an as many files, or portions of files, as you like in separate windows. Movement and transfer of text between windows is simple. You can even edit the same file in 50 windows at the same time. If you change a file in one window, your change is automatically reflected in the other 49! You'll agree with *Computer Language*, "While other editors limit you in various ways, BRIEF lets you devise any [windowing] configuration." Page 123-125, *Computer Language*, Sept. 1987, Author: Chris Wolf

3 WINDOWS ON THE WORLD. Why the excitement? First, BRIEF's architecture. *Any number of files* of virtually any length can be open. (Start BRIEF with "★.★" to prove it.) Open as many tiled windows as fit the screen—over/under and side-by-side—to work on any of your files. Open, close, and resize windows as you go. In each window, full screen or tiny, all editing techniques are at hand—high-speed cursoring, paging up and down, horizontal scrolling, optional word wrap. Load the same file in any number of windows to view different areas simultaneously. A change in one changes all. Cut and paste text blocks between windows and files, or into buffers for later recall. All files stay in memory, so you can always go back to snip some more.

4 WHOLLY MACROS. Much of BRIEF was written in its own macro language. It is that powerful! The language and its compiler come with every copy, as do many standard macros, with source code for learning by example. It is a complete language with conditionals, loops, recursion, global and local variables, even data types. It can control files, windows, and the keyboard. It has structure, 32-character variable names, and—not at all like 1-2-3®'s cuneiform—is entirely readable, like a hybrid of LISP and C. With it you can develop a library of routines to power BRIEF your way.



5 UNDO. NOT UN-DELETE. Don't confuse the two. BRIEF doesn't just keep snapshots of recent deletions should you want to pick them up from the cutting room floor. It can reel the whole film backward undoing any command that affected the cursor or the text. Watch it undo a global replace, for example. Uncanny. It can back up 300 times, all the way to the beginning of a session. "Works like a dream", said *The C Journal*.

6 SHELL GAMES. Leave BRIEF, run your compiler, print out the error messages, load up BRIEF again? No way! Run your compiler from *inside* BRIEF*. It will point to each error line in your source program, still loaded in memory, for immediate editing. You don't have to leave BRIEF to use DOS either. BRIEF disappears from the screen to get out of your way, but say bye to DOS and BRIEF pops back to the screen, as do all the files you were working on.

7 KEY WHIZ. You can reassign BRIEF's command keyhits to whatever keys you're used to, even your old editor's, so you don't have to send your fingers back to school. Macro execution can be assigned to single keys. Or you can tell BRIEF to listen while you tap out a complex routine. It will save and playback faithfully, a shortcut macro without a single line of coding.

8 MULTI-LINGUAL. BRIEF's macro language is perfect for writing formatters for your language which indent, match up parentheses and brackets, and set up statement templates for fill-in. BRIEF comes with C language support already built in. Others have written macros to format Pascal, BASIC, LISP, Prolog, FORTRAN.

9 QUICKER PICKER-UPPER. Looking for something? BRIEF has full UNIX®-like expression search tools to forage and find and fix any file in memory. Literal strings with wildcards and "?" character masking, sure. But also indifference to case or intervening characters, [aeiou] to match all vowels, or [~aeiou] to match anything *but* vowels, [a-f,l-m] to match character ranges, beginning or end of line searches, even multiple choice pattern matching and replacement.

10 REASONS 11 THROUGH 20: **11.** BRIEF comes with a color option. You can select your own color scheme anytime. **12.** It supports EGA's 43-line mode and can display up to 128 lines long. **13.** Full 8-bit ASCII display; the whole character set can show on screen. **14.** Full path support. **15.** Command line start-up flags to modify BRIEF's behavior, change a path name, or run a macro: for example "wp" which turns BRIEF into a word processor with wraparound and margin setting. **16.** Automatic file save during idle moments. **17.** Compatibility with most stay-resident programs (like Sidekick™), multi-taskers (like Microsoft Windows™), and networks. **18.** A bulletin board with public domain macros contributed by a mushrooming cult of macromancers. **19.** No copy protection. **20.** Context sensitive help, and phone support from the publisher.

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* Brief needs 192k normally. 320k for compile feature. *Product must be returned in resalable condition.

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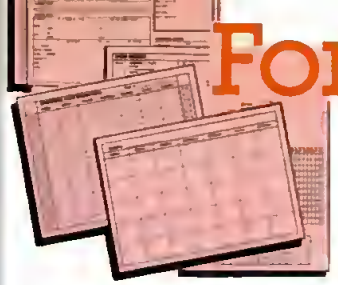
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B-Tree File Manager Now Has Report Generator

c-tree: The only major b-tree file manager that comes with built-in network support rather than a costly separate version, c-treeTM is sturdy code that has weathered many seasons of prolonged and widespread use It comes in C source, so you can modify it to fit a special case, permits any number of keys for a date file—alpha, numeric even floating point, handles files with varied record lengths and multiple keys in one index file In short, you get the works—and there are no royalties

C-tree a design splits nodes to allow any number of users to access an index file simultaneously even when updates are in progress So multi-user configurations and adaptation to networks are possible Record-locking routines are provided for DOS 3 x, UNIX, XENIX

C-tree can travel Tests in many environments prove that c-tree gives your application a ticket to anywhere

r-tree: thousands of c-tree users (and you) now have a suddenly expanded ability to produce ad hoc reports from files maintained by c-tree (v 4 1E or later), side-stepping the elaborate C coding usually entailed

Once you link a description of the field characteristics of the data files to the r-tree library, you are free to use an ordinary text editor to write any number of report scripts with no further C coding Reports can access data in several files, select to match complex searches, join the findings into new logical records sort them, calculate new fields and columns tabulate by any number of control breaks Your script files show visual representations of report images—not just rows and columns, but customized layouts

r-treeTM comes in source code and is designed for the same portability c-tree brings you Fits any compiler

	List	PC Express
c-tree F0660	$395	$285
r-tree F0665	$295	$235
Combined F0664	$650	$499

ESSENTIAL C UTILITY LIBRARY

400 Functions, 30c Each

You've probably seen the speed and power of Essential's C function library without knowing it Software greats have been using it for some time to give today's top products pizazz and panache

Now grown to 400 functions Essential produces pop-up menus, saves and restores screens and windows to disk or memory in as little as 1/10th second, and claims the fastest video output available Library has 50 business graphics functions, 40 string handlers, 28 functions for printers, 18 for mice, 11 for time and date, DOS interface functions for disk error trapping, directory and file creation and management, lots more Everything in source, including sample programs We have versions with pre-built libraries for the well-known C compilers, and a source code librarian is supplied for rolling your own

	List	PC Express:
C Utility Library	$185	$119
Essential Graphics	$250	$183
Essential Communications with Breakout Debugger	$185 $250	$125 $189

Shopping List for the Power Workbench

	LIST	UB
ASSEMBLER		
Microsoft Macro Assembler with Utilities	150	109
PASM 86 *by Phoenix, Macro Assembler*	195	98
ASSEMBLER Support		
Btrieve Softcraft's File Manager	245	169
GSS CGI....*Device Independent graphics*	495	375
BASIC		
Microsoft BASIC Interpreter..*for XENIX*	350	Call
Microsoft QuickBASIC..*Ver 4.0*	99	Call
Turbo BASIC.....*NEW from Borland*	99	64
BASIC LIBRARIES & UTILITIES		
Btrieve Softcraft's File Manager	245	169
GSS CGI...*Device Independent Library*	495	375
Halo Graphics by Media Cybernetics	300	219
Source Print...*Aldeberan's beautifier*	99	75
Tree Diagrammer..*Also from Aldeberan*	77	67
C LANGUAGE COMPILERS		
C86 PLUS by Computer Innovations	497	397
Lattics C Compiler Now ver 3.2	500	299
Let's C Compiler from Mark Williams Co	75	55
Mark Williams C full development system	495	369
Microsoft C Compiler with free CODEVIEW	450	295
Microsoft QuickC....*Special Price*	99	64
Turbo C.....*New from Borland*	99	94
C LIBRARIES—Communications		
Asynch Manager by Bleise	175	135
Greenleaf Communications	185	139
Essential Communications	185	125
Essential Communications Plus	250	169
C LIBRARIES—FILE MANAGEMENT		
Btrieve Softcraft's File Manager	245	169
Btrieve/N File Management for Networks	595	429
Ctree by Faircom,with full source	395	285
Rtree..*Report Gen. for Ctree*	295	235
Ctree & Rtree....*Special Combination*	650	499
dBC ISAM Accesses dBase files	250	189
with Source code	500	349
dBC III Plus multiuser	750	499
with Source code	1500	995
Opt Tech Sort Super fast sort for Btrieve	149	105
C LIBRARIES—Graphics		
Essential Graphics..*no royalties*	250	183
GSS CGI..*Device Independent graphics*	495	375
GSS Metafile Interpreter stores images	295	235
Halo by Media Cybernetics	300	219
with Dr Halo III.....*Paint Utility*	440	299
Helo For Microsoft Languages	595	434
C LIBRARIES—Screen Design		
Curses from Lattice,UNIX lookalike	125	99
with source	250	199
C Worthy ...*by Custom Design Systems*	195	Call
C Worthy with Forms	295	Call
Greenleaf Date Windows	225	155
with source	395	249
Microsoft Windows Dev. Toolkit	500	Call
Panel Plus by Roundhill	495	395
View Manager for C,Bleise	275	199
Vitamin C...*Creative Programming*	225	199
VC Screen...*Source code Generator*	100	91
Windows for C	195	149
Windows for Date	295	259
2view....*Data Management Consultants*	245	175
C UTILITY LIBRARIES		
Basic C ...*Basic-like routines for C*	175	139
Bleise C Tools Plus/5.0 ..*f/MsC & QuickC*	129	99
Bleise Turbo C Tools...*f/TurboC*	129	99
C Food Smorgesbord by Lattice	150	109
C Utility Library by Essential,300 functions	185	119
Greenleaf Functions	185	139
PforCe by Phoenix, vest library	395	194
OTHER TOOLS		
BASTOC...*JMI,Translates BASIC to C*	495	399
dBX Translator.....*dBASE to C translator*	550	419
with Library Source	950	725
Pre/C....*by Phoenix, like UNIX lint*	295	144
PC-LINT..*by Gimpel, subset of UNIX Lint*	139	125
COBOL		
Micro Focus COBOL/2	900	795
Micro Focus Toolset	900	795
Micro Focus Personel COBOL	149	134
Microsoft COBOL Inc. COBOL Toole	700	Call
for XENIX	995	Call
RM/COBOL..*by Ryan McFarland*	950	675
RM/COBOL 85...*ANSI 85*	1250	995
COBOL Support		
Btrieve Softcraft's File Manager	245	169
GSS CGI...*Device Independent graphics*	495	375
Halo....*from Media Cybernetics*	300	219
RM/Screens..*Screen generator*	395	335
RM/Net+ 5..*R/M COBOL networking*	300	249
OBASE & RELATED PRODUCTS		
Applications Plus....*Fox & Geller*	499	279
Briel & dBriet..*Editor/Mecro lang for DBase*	275	Call
Clipper.....*Nantucket's DBase Compiler*	695	Call
DATA-p.....*Wellsoft*	60	50
dBC III Plus supports multiuser commands	750	499
with Source code	1500	995
dBC ISAM..*accesses dBase files*	250	169
with Source code	500	349
dBX Translator.....*dBASE to C translator*	550	419
with Library Source	950	725
dFlow.....*Wellsoft*	149	124
Documenter.....*Wellsoft*	295	244
FoxBase+ ....*Fox Software*	395	Call
Multiuser version	595	Call
QuickCode Plus. .....*Fox & Geller*	295	179
QuickEntry.....*Fox & Geller*	99	59
QuickReport.....*Fox & Geller*	295	179
Source Print..*Aldeberan's beautifier*	99	75
Tree Diagrammer..*Also from Aldeberan*	77	67
UI Programmer...*Wellsoft*	295	244
FORTRAN Compilers & Utilities		
GSS Graphics Development Toolkit....*CGI*	495	375
GSS GKS..*Kernel Sys,ANSI Level 2b*	495	375
Halo.....*from Media Cybernetics*	300	219
Microsoft Fortran..*Ver 4.0,inc. Codeview*	450	Call
for XENIX	695	Call
R/M Fortran..*ANSI 77 by Ryan McFarland*	595	399
for XENIX	750	599
Spindrift Library....*By Spindrift Labs*	149	129
Source Print	99	75
Tree Diagrammer	77	67
PROLOG		
APT..*PROLOG Tutor*	65	50
Arity PROLOG Compiler & Interpreter	650	569
Arity PROLOG Interpreter	295	229
Arity Standard PROLOG	95	77
PROLOG-86 Plus.....*Solution Systems*	250	199
Turbo PROLOG...*Borland Intl.*	100	63
Turbo PROLOG Toolbox...*Borland*	100	64
TEXT EDITORS		
Brief.....*from Solution Systems*	195	Call
dBrief..*Macro lang for Brief & DBase*	95	Call
Brief & dBriet Combo	275	Call
Condor Editor....*Condor Corp*	130	69
Epsilon...*Lugaru*	195	149
KEDIT.....*Mensfield..identical to XEDIT*	125	99
Pmets.....*Phoenix*	195	98
Vedit Plus.....*Compuview*	185	129
DEBUGGERS		
Advanced Trace 86.....*Morgan*	175	119
C-Sprite..*Source debugger for Lattice C*	175	139
Periscope I...*Board, Switch, Software*	345	289
Periscope II..*Breakout Switch & Software*	175	139
Periscope II.....*Software only*	145	105
Periscope III....*8 Mhz*	995	795
Periscope III...*10 Mhz*	1095	875
Ptix 86 Plus....*Phoenix symbolic debugger*	395	194
PHOENIX		
C/PAC.....PForce & Pre-C	495	299
Pasm 86.....*Mecro ASSEMBLER*	195	98
Pdisk... *Disk Management Utility*	145	89
PFentery....*six-pack take-away*	995	549
PFinish.....*Profiler*	395	194
PFix 86 Plus.Symbolic Debugger	395	194
PForCe.....*Utility library*	395	194
PforCe ..*Pforce for C*	395	194
PLink 86+ ...*sophisticated overley linker*	495	259
PMaker .....*make utility*	125	89
Pmete .....*Text Editor*	195	98
Pre-C.....*Super-set of UNIX Lint*	295	144
Ptel.....*Binary Transfer Program*	195	39
POLYTRON		
PolyBoost.. *Software accelerator*	80	64
PolyDesk III ..*3rd Generation Desktop org*	99	73
PolyLibrarien..*Library Meneger*	99	73
PolyLibrarien II	149	109
PolyMake .....*Complete MAKE Utility*	149	109
PolyShell....*UNIX-like Command Shell*	149	109
PolyXREF2..*Cross Reference Util all lang*	219	169
PolyXREF2..*Single Language support*	129	99
PVCS Corporate ..*Source Code Control*	395	300
PVCS Personel...*Personalised ver of above*	149	109
PVCS Network..*Powerful Ver of PVCS*	Call	Call
RYAN McFARLAND		
RM/COBOL.....*ANSI 74 Standerd*	950	675
for UNIX or XENIX	1250	999
RM/COBOL 85.....*ANSI 85 Standerd*	1250	995
RM/FORTRAN.....*ANSI 77 Standerd*	595	399
for UNIX or XENIX	750	599
RM/NET+ 5..*COBOL Networking*	300	249
RM/Screens.....*COBOL 85 Screen generator*	395	335
SOFTCRAFT		
Btrieve Softcraft's File Manager	245	198
Xtrieve...*Query language for Btrieve*	245	220
Report Option for Xtrieve	145	129
Btrieve/N File Management for Networks	595	429
Xtrieve/N.....*Multi-User Query*	595	459
Report Option/N...*Multi-user Rep Opt*	345	289
XQL...*SQL for Btrieve*	795	595

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In-synch Remote Control Computing Use a PC at one location to easily access any software, spreadsheet, memo, files at another location just as if you were sitting in from the remote computer PC Express is offering you two for the price of one—just **$295 for both**

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PC EXPRESS™ PROGRAMMER'S WORKBENCH

HALO
Graphics Tools for Software Developers

When choosing your graphics tools for software development, performance is crucial. The best proof of HALO's superior performance is in the number of Independent Software Vendors (ISVs) that develop and distribute HALO-based applications. Over 190 ISVs selected HALO because HALO out performs the rest, HALO is easier to program and shortens time-to-market. HALO is complete with over 190 functions, 17 programming languages, and HALO supports a wider range of devices—over 110.

Since 1981 HALO has been the industry standard library of graphic subroutines for the PC. HALO has an installed base of 60,000+ end users and hundreds of site licenses.

A single copy of HALO includes all device drivers, your choice of one compiler binding, LearnHALO (an interactive tutorial), free 800 # technical support, and the license to use HALO on one machine. Flexible, practical licensing terms are available for ISVs and "Sites."

	List	Ours
Halo	**$300**	**$219**
with Dr. Halo III	**$440**	**$299**
Halo for Microsoft	**$595**	**$434**

GREENLEAF LIBRARIES

Functions

C source, assembler source, and binary libraries of 225 functions for many compilers. Emphasizes tight functional groupings to minimize loading code which your application may never use. Manual's 250 pages help select functions, as do demos, bulletin board.

Communications

Communicate from within your own C programs! Over 120 functions and demo programs in C and assembler source to set up interrupt-driven asynch communications for up to 16 channels. Up to 9600 baud, ASCII or binary, any parity or word length, 8250 UARTs, Xon/Xoff and Xmodem, WideTrack receive. Goodbye separate communications software. Specify compiler.

Data Windows

Windows, menus and data entry do work together when you utilize Greenleaf's screen architect. This smooth screen designer offers device independence, logical windows, table driven data entry and economical pricing. Source code is also available.

	List	Ours
Communications	**$185**	**$139**
Functions	**$185**	**$139**
Data Windows	**$225**	**$169**
Complete 3 in 1 Pack	**$595**	**$399**

WINDOWS FOR DATA *M'soft Windows Comp*

Windows for Data™ adds the pizazz and practicality of window partitioning for entering data in your application. Powerful field-level functions let you specify prompt string, field length, data type, screen location, picture, receiving variable, etc. Field options can require or prevent entry, cause beeping on invalid entry or overflow, attach field-specific help messages, functions to call for entry validation. You control which keys clear a field, jump to next or prior fields, quit, etc.

The Windows for C subset has all the windowing functions without data entry. Unlimited windows, defined in C structures for reference throughout your program, can be made either to pop up or permanently overwrite the screen. Routines scroll and highlight lists with arrow keys, read and scroll ASCII files both ways in windows. Logical treatment of video attributes permits unchanged programs to run on color or monochrome. Colors of windows are set individually. All functions are in separate modules. Only those used are linked. Only buffers holding on-screen or temporarily obscured windows occupy RAM, others released dynamically. Clear documentation.

Specify compiler	List	PC Express
Windows for Data	**$295**	**$259**
Windows for C	**$195**	**$149**

BTRIEVE *B-tree File Manager Plus Add Ons*

If networks are on your horizon betting your future on Btrieve as the one file manager for your C, Pascal, BASIC, and COBOL projects looks like a smart move. Reason? Novell bought Btrieve's creator.

Btrieve's function library takes complete charge of all file creation, indexing, reading, writing, insertion, deletion, space recapture, forward and backward searching. Its balanced-tree indexing scheme finds any key in a million in four or less accesses. Files may have up to 24 indexes, fixed record length to 4090 characters, variable length to 64k, indexes up to 255 characters, files of 4 billion bytes.

List **$245**, Ours **$169**. Network Version List **$595**, Ours Only **$429**. And Ask about Xtreve for Btrieve file inquiry and Rtrieve for report writing. All three in versions for any network that supports the MS-DOS 3.1 file sharing function.

PANEL PLUS *Screen*
Favorite Has Library Source

There are no screen design and data entry tools quite like Panel Plus. With it you design a screen under program control, use Panel's utility to "run" and test it field by field, then pass it to Panel's code generator which delivers C source code to work with as you please. The code calls Panel Plus's function library, but now *the library comes in source*, so everything is portable and changeable.

Has every imaginable feature. A screen can have 1000 fields stacked 127 levels deep. Each field can be boxed, colored, multi-row, word-wrapped, scrolled four ways, linked to help messages, matched to a picture, validated after data entry—it's exhaustive.

Operates in graphics mode via interfaces of graphics products it supports. Handles EGA's 43 line screen. Adaptable to various keyboards, screens, operating systems. Major tool with years of evolution. List **$495**. Here **$395**.

BLAISE C TOOLS PLUS/5.0

C TOOLS PLUS/5.0 from Blaise Computing Inc. helps you to quickly build professional applications using the full power of Microsoft C 5.0 and QuickC. Now you can concentrate on program creativity by having full control over DOS, menus, interrupt service routines, memory resident programs, fast direct video access, windows, printer and keyboard control, and more!

Blaise Computing's attention to detail, like the use of full function prototyping, cleanly organized header files, and a comprehensive, fully-indexed manual, makes C TOOLS PLUS/5.0 the choice for experienced developers as well as newcomers to C.

C TOOLS PLUS/5.0 prebuilt libraries are ready to use with either QuickC or the Microsoft C 5.0 command line environment. Complete documented source code is included so that you can study and adapt it to your specific needs.

	List	Ours
C TOOLS PLUS/5.0	**$129**	**$ 99**
Turbo C TOOLS	**129**	**99**
C ASYNCH MANAGER	**175**	**135**
Turbo POWER TOOLS	**99**	**75**
Turbo ASYNCH PLUS	**99**	**75**

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C-WORTHY INTERFACE LIBRARY *NEW VERSION!*

The C-Worthy™ Interface Library wraps an entire user interface around your application. Its full power can be summoned by only a few high level calls. Sound exaggerated? A single function call can set up a complete text editor in a screen window. Recently acquired by Solution System, over 800 pages of Documentation, Turbo and Quick C version and a complete Interface Library have been added.

- High level calls pop menus and scrollable choice lists to the screen, restoring the background when dismissed.
- Windowing facilities open portholes of up to screen size for viewing virtual screens larger than the physical screen.
- Full context-sensitive help screen management takes over these chores and error messages. Automatic routines interrupt with pageable text windows explaining what to do next.

Novell found it "played a key role and accelerated development" in making its NetWare™ utilities easier for users. Ingenious demo, call for it.

Ask for	List	Ours
C-Worthy	**$195**	**Call**
with Forms Library	**$295**	**Call**

BASTOC *BASIC Into C*

For a trifling price, BASTOC™ moves truckloads of BASIC code over to C. It's a translator which takes in Microsoft Extended BASIC and emits pure K&R C for Microsoft or Lattice. Structures even convoluted BASIC code. Optimized to dramatically reduce execution time. Dynamic string allocation ends BASIC's catatonic halts for garbage collection. Huge worksaver. List **$495**, Us **$399**.

POLYTRON VERSION CONTROL
Source Code Control for Any Language

PVCS allows programmers, project managers, librarians and system administrators to control the proliferation of revisions and versions of source code in software systems. Independent programmers, the leading software publishers and LAN companies and hundreds of Fortune 1000 companies rely on PVCS to store and retrieve multiple revisions of text. It maintains a complete history of revisions as an "audit trail", generates status reports, and uses intelligent "difference detection" to minimize disk space for each new version.

On Corporate and Network PVCS simultaneous changes to a module are merged into a single new version. If changes conflict, the user is notified. The "Logfiles" used to track changes are interchangeable between any PVCS product.

Corporate PVCS is for multiple programmers. It includes "branching" to maintain code when programs evolve on multiple paths. Personal PVCS offers most of the power and flexibility of corporate PVCS, but excludes multiple programmer features. Network PVCS is the Corporate version for LANs. File locking and security levels can be tailored to each project.

PolyMake Still using a prehistoric Make? Step up to PolyMake, the most popular and powerful Make utility. Most flexible macros of any Make. Now integrated with PVCS and PolyLibrarian for faster performance and precise configuration management.

Ask for	List	Ours
Personal PVCS	**$149**	**$109**
Corporate PVCS	**$395**	**$309**
Network PVCS	**Call**	**Call**
PolyMake	**$149**	**$109**

GSS GRAPHICS SYSTEM
Leave the Device Driving to GSS ANSI CGI STANDARD

For serious applications stick to the tools that stick to the standards. Not the least of reasons why GSS™ has emerged as the pre-eminent graphics toolmaker is that it has always conformed to ANSI standards.

At the heart of the system is the CGI standard Development Toolkit. It has all language interfaces and device drivers for keyboards, mice, joysticks, tablets, printers, plotters, cameras. The drivers completely insulate your application from concern for device idiosyncracy.

GSS Kernel™ conforms to ANSI's GKS 2b and has all its drivers and language bindings. Macro level tools to draw, color, segment, transform, store and recreate an object. The Metafile Interpreter reads ANSI CGM files with full CGI capability for recreation on various devices.

Quality software? IBM thinks so. They sell GSS under their own label. Royalties. Needs 256k.

Ask for	List	Ours
CGI Dvlpmt Toolkit	**$495**	**$375**
Kernel System	**$495**	**$375**
Kernal for IBM RT	**$795**	**$645**
Metafile Interpreter	**$295**	**$235**

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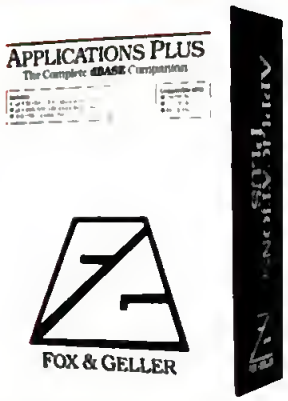
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PC EXPRESS: YOUR SOURCE FOR dBASE ENHANCEMENT TOOLS

APPLICATIONS PLUS For dBASE

The Complete dBASE Companion



Who says you can't have it all?

APPLICATIONS PLUS has *everything* you need to get the most out of dBASE. An application generator (QUICKCODE PLUS), relational report writer (QUICKREPORT), and graphics system (dGRAPH).

QUICKCODE PLUS offers *dozens* of features you've *never* seen before in a dBASE code generator. Relational applications that read, display, and update a dozen or more databases simultaneously. "Real-time" calculations, performed *on screen* as the user enters each field. Forms up to 11 screens long, with the ability to pass data between screens. Computational formulas that automatically combine data from *different* databases. 9 Data types. 16 field types.

QUICKREPORT is a full-featured relational report writer, which combines up to 6 databases in one report, handles many-to-one relations, fancy printer features (like **bold** and *italics*), computed fields, and up to 16 levels of totalling and sorting.

dGRAPH is a graphics system that produces bar, pie, line, and piebar charts directly from dBASE data. Dozens of options let you tailor graphs to your needs.

APPLICATIONS PLUS is 100% compatible with Clipper and FoxBASE+.

	List	Ours
APPLICATIONS PLUS	$299	Call
QUICKCODE PLUS	$295	$170
QUICKREPORT	$295	$170
QUICKENTRY	Call	Call

CLIPPER *From Nantucket*

Compile dBASE for Speed, Protection

Clipper™ turns lumbering dBASE® into a speed dMON with benefits bobbing in its wake. your source code is submerged from public view, you can distribute your compiled application without royalties, and your customers don't even need copies of dBASE! The Summer '87 Clipper offers index files compatible with dBase III Plus, and networking capabilities to run compiled programs on major networks supporting DOS 3.1 with no restrictions on number of users. Clipper offers arrays, menu-building commands, user-defined functions, context-sensitive help techniques for applications, a debugger, and it supports Expanded Memory. It goes well beyond dBASE with 1,024 fields per data base and 2,048 active memory variables.



Clipper has the power to save and restore multiple screens to and from memory variables. You can also create overlays, call object modules compiled in other languages, and create function libraries to link with your applications. Power and flexibility make it the #1 dBASE compiler. List **$695**. Ours **Call**.

McMAX *From Nantucket*

Like dBASE for the Macintosh

McMax™ is like running dBASE on the Macintosh. It combines an easy-to-use menu-driven ASSIST mode using the Mac interface, an interactive command mode like dBASE at the dot prompt, and an application programming language fully compatible with dBase III. It gives you the power to create dBASE language applications on the Macintosh and transfer back and forth to the IBM® world. McMax accommodates up to 16 million records, 32,000 characters per record, 255 characters per field, and up to 32 files open concurrently. No copy protection. List **$295**. Ours **Call**.

dBC *Identical dBASE III Plus Files Using C*

dBC™ is a series of C libraries from Lattice which creates, accesses and updates files identical to those of dBASE itself. So dBASE can read and update the files too.

What for? It means both C and dBASE applications can operate on the same data bases interchangably. It means C programmers can interface with the big market of dBASE users out there, yet side-step the dBASE language. It means dBASE applications can now be linked to the universe of C libraries and tools to add windows, graphics, statistical analysis, all the things dBASE cannot do. It means the speed and power of C to impress clients accustomed to dBASE!

dBC's functions parallel all dBASE's file handling commands, many decomposed to permit direct data manipulation. Ten each of data, index, and memo files may be open at once. It's so complete an ISAM package that you can forget dBASE and use dBC only for C programming.

Our versions of dBC mimic file formats for dBASE II and III and now dBASE III Plus makes your programs network ready! — as many stations as a network allows. Hands-off mode handles record and file locking and unlocking automatically. Close in functions give you direct lock/unlock control.

Supports all four memory models. Specify compiler and dBASE version. Call for Source Pricing.

dBaseII, III. List **$250**. Ours **$169**. For dBaseIIIPlus. List **$750**. Ours **$499**. Call for Full Source Pricing.

WALLSOFT'S THE UI PROGRAMMER

Code generator for dBASE

The UI Programmer was developed for professional dBASE programmers who have been frustrated in the past by code generators. Up until now, a serious dBASE programmer had to take whatever code a generator produced and modify it to their needs. With UI, the developer can generate exactly the dBASE code wanted.

UI (User Interface) has two main functions: the first is a powerful forms editor to create sophisticated screen and menu forms in a matter of minutes. The editor is completely menu-driven. It works on the "point-and-shoot" principle—just put the cursor where you want and tell UI what to put there.

UI's other, more important, main function is generating code for the forms you've designed. Once you have a form the way you want it, you call up the "Generate" menu, and tell UI which template you want to generate the code with. That's the key—each template tells UI to produce a different kind of dBASE program.

It's through these templates that you can *program* the way UI generates source code. You can use the templates that come with UI "as is" (there are about 25 of them), completely rewrite them, or write your own. So you don't lose control of *design*, like you do with other generators. You just let UI do the tedious work.

	List	Ours
UI	$295	$244
DOCUMENTOR	$295	$244
dFLOW	$149	$124
DATA-p	$ 60	$ 50

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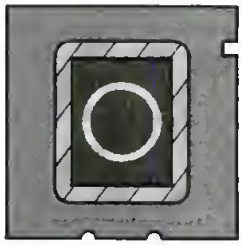
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■ MITT JONES



PC ADVISOR

Help in catching on to computer lingo, in debugging dBASE III programs, in converting image files, and in adding search-and-replace to Lotus 1-2-3.

COMPUTER LINGO

I enjoy your magazine immensely and have learned a lot from reading the columns and product reviews. However, as a relative newcomer to computers I often see terminology I don't understand. Can you suggest a good dictionary of computer terms?

Cheryl O'Neil
Boston, Massachusetts

Our diligent proofreaders, who among other things ensure that we editors haven't written byte *when we were thinking* bit *or* transformer *when we were thinking* transistor, *depend on a couple of reference books to keep the lingo straight.*

The Computer Dictionary *($24.95; ISBN: 0-672-22205-1; Howard W. Sams & Co., Inc., Indianapolis, Ind.; (800) 428-7267), by Charles J. Sippl, includes brief explanations of more than 12,000 terms used in the computer industry. The definitions are surprisingly clear and informative. For instance, the explanation of "transfer rate" includes an important differentiation between burst rate and average rate.*

Computer Acronyms, Abbreviations, Etc. *($14; ISBN 0-89433-172-8; Petrocelli Books Inc., Princeton, N.J.; (609) 924-5851), by Claude P. Wrathall, includes nearly 500 pages of acronyms and abbreviations and their meanings.*

FILE MAGIC

I've been looking high and low for a program or utility that would take graphics images created in *Dr. Halo* and convert them to images that *PrintMaster* and *NewsMaster* could use. Do you know of such a package?

Alan J. Anderson
San Francisco, California

Pick up a copy of Hijaak *($89; Inset Systems, 12 Mill Pond Rd., Danbury, CT 06811; (203) 794-0396).* Hijaak *will handle your translation—from* Dr. Halo *.CUT files to* PrintMaster *and* NewsMaster *.SHP files—with no problem. However, you may also need* Inset, Hijaak's *sister product, if you're trying to convert from color images to gray-scale images. The two products sell as a unit for $149.*

Hijaak *can also handle bidirectional translations of many other formats, including CompuServe (.GIF),* MacPaint *(.MAC),* PC Paintbrush *(.PCX), and TIFF.*

Some of the conversions can get a bit tricky, especially if you're trying to convert vector images to bit-mapped images or if conversion to gray-scale images is necessary. But the time you spend tinkering with the package won't compare to the time you'd otherwise waste trying to duplicate your images.

■ Slightly larger than a pack of cigarettes, the Worldport 1200 modem plugs into a serial port and runs off a standard 9-volt battery.

TRAVELLING LIGHT

The Toshiba T1000 did me in: I can resist buying a laptop machine no more. But now that I've found a quality machine at a price I can afford, how do I find a modem that's equally affordable? Toshiba's $399 modem for the T1000 seems over-priced.

Dan Peterson
Chicago, Illinois

Touchbase Systems Inc. sells its external Worldport 1200 for $199. Slightly larger than a pack of cigarettes, the Worldport 1200 modem plugs into a serial port and runs off a standard 9-volt battery. The Worldport should perform well on any machine and even boasts four diagnostics lights. It ships with a 7-foot phone cord and an acoustic coupler adapter cable.

1-2-3 SEARCHES

When I upgraded to *Lotus 1-2-3*, Version 2.01, I had hoped I'd find a search-and-replace function. Of course, I didn't. With all the add-in products now available for *1-2-3*, surely somebody has thought to add search-and-replace?

S. German
Houston, Texas

Several 1-2-3 *add-ins now offer search-and-replace features, including Turner*

■ PC ADVISOR

Hall Publishing's Spellin! *and* Note-It Plus. *Turn to our feature articles on* Lotus 1-2-3 *add-ins in the January 26, 1988, issue of* PC Magazine *for a look at those packages and others.*

In addition to the products you'll see there, two newer products add search-and-replace features.

The Worksheet Utilities *($99.95; Funk Software Inc., 222 Third St., Cambridge, MA 02142; (617) 497-6339) lets you search entire worksheets or specified ranges for labels, values, functions, formulas, and cell references. The package also gives you a formula editor, a full-screen file manager, automatic backup ability, and a few other niceties.*

If you don't want to pay for features you may not need, however, your best bet may be Search-Replace *($34.95; SMI Corp., P.O. Box 582221, Tulsa, OK 74158; (918) 560-9536). Like* The Wordsheet Utilities, Search-Replace *lets you search all the text in your worksheets, including formulas. You can specify search range, direction, and case sensitivity.*

dBASE HELPERS

Despite the relative simplicity of the *dBASE* language, debugging large programs can be time-consuming and frustrating, and *dBASE*'s debugging facilities are little help. I've seen separate debuggers for C, Pascal, and other popular languages. Does anybody make a powerful debugger for *dBASE*?

Julie Rogers
Detroit, Michigan

You're in luck. We reviewed the first source-level debugger for dBASE *in our December 22, 1987, issue.* dBUG III *($195; HJS Research Inc., Monmouth Junction, N.J.; (800) 323-1809) allows you to easily monitor variable values and it also gives you a variety of ways to execute your* dBASE III *programs.*

For instance, you can execute your programs one line at a time and check your variable values or output after each line. dBUG III *runs within* dBASE, *so you can toggle between* dBASE *and its menu interface at will.*

You might also want to pick up a copy of Clear for dBASE *($99; Clear Software Inc., Brookline, Mass.; (617) 731-6976).* Clear *not only helps you document your programs by generating annotated flowcharts, but also lets you step through your flowchart decision nodes one step at a time to help you spot logic errors. This approach lets you concentrate on the logic of your program before you invest hours filling in the actual program code.*

ASK THE ADVISOR

Send you questions to the PC Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016.

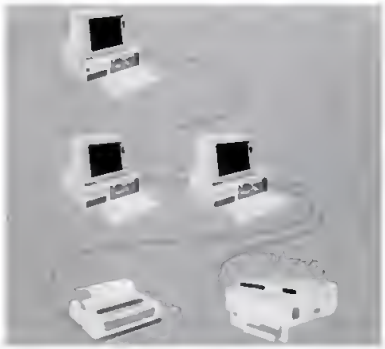
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***PC Magazine*, June 23, 1987**

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***Business Software*, June 1987**

"(EasyLAN)...unlike full-scale systems, is easy to install and maintain, and requires little training for anyone who's already familiar with MS-DOS."
***Personal Computing*, June 1987**

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- Adjusted I/O bus speed for add-on cards compatibility
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- Up to 15 megabyta system extension memory, 8 megabyta EMS
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- supports local taxes
- automatically posts payroll expenses to General Ledger and Jobcost
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- deducts for taxable benefits
- automatically retains QTD and YTD employee earnings, deductions and associated payroll expenses
- accumulates 940, 941, W-2 and state tax information
- produces immediate employee reports on screen or printer including W-2 forms, employee mailing labels, payroll journals, QTD and YTD reports of earnings & deductions, and employee record reports.

ACCOUNTS RECEIVABLE

- uses open invoice method to keep track of full or partial payments against any customer invoices
- fully paid invoice may be purged or retained
- automatically updates inventory and ledger accounts, and project records
- user can define aging periods
- reports produced on screen or printer including mailing labels, aged summary, aged detail and receivables journal
- automatically displays customer names and numbers on screen when required for program input
- prints computerized invoices or supports manual invoicing
- prints computerized customer statements with remittance stubs

ACCOUNTS PAYABLE

- uses open invoice method to keep track of full or partial payments against any supplier invoice
- fully paid invoices may be purged or retained
- automatically updates inventory records, project records and ledger accounts
- user can define aging periods
- produces immediate vendor reports on screen or printer including mailing labels, aged summary and details, and payables journal
- automatically displays vendor names and numbers on screen when required for program input
- prints computerized checks or supports entry of manual checks

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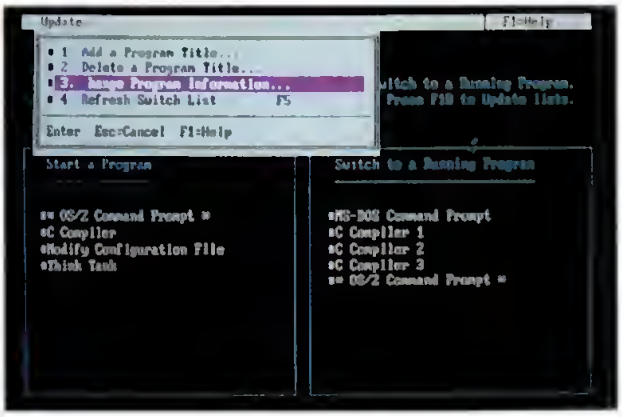
FIRST LOOKS

Compaq's Version of MS OS/2 Offers IBM Compatibility with Few Extras

PC HANDS ON

BY CHARLES PETZOLD

OS/2 1.0, the multitasking operating system developed by Microsoft and IBM for 80286- and 80386-based personal computers, is now available from Compaq Computer Corp. for its machines. Except for the installation procedure and a couple of other features, Compaq's version of MS OS/2 is very similar to the version of OS/2 that IBM began selling in December. (See the accompanying sidebar, "IBM OS/2 and MS OS/2: What's the Difference?")



The Program Selector in Compaq's OS/2 looks the same as IBM's, but each comprises distinct OS/2 programs, and Compaq's takes up 128K less disk space.

Compaq's MS OS/2 comes on three high-density floppy disks. The package includes both 5¼- and 3½-inch disk formats. A 70-page Beginning User's Guide, a 130-page Setup Guide, and a 300-page Reference Guide are supplied in a single binder.

Unless the hard disk on your Compaq has a primary partition greater than 32MB, installation of MS OS/2 is simple and fast. You put the installation disk in drive A: and reboot. OS/2 then runs the normal OS/2 Program

(continues on page 35)

New DisplayWrite Version: First Mainstream Application for OS/2

PC HANDS ON

BY MITT JONES

DisplayWrite has long earned its keep by providing a smooth transition from IBM Corp.'s standalone DisplayWriter word processing system to the DOS world. Each revision of the product sports a few modest enhancements, but the cantankerous ways and reason-defying command scheme of the original DisplayWriter remain stubbornly intact.

It seems both ironic and fitting, then, that the latest incarnation of the package—*DisplayWrite 4/2*—offers itself as the first major application for OS/2. Fitting because *DisplayWrite* has long held a transitional role. Ironic because *DisplayWrite* users—a breed who would rather fight than switch—may be forging the way for all of us into OS/2.

DisplayWrite 4/2 is a true OS/2 API (application program interface) application, running in protected mode. In a nutshell, this means you've got access to nearly all of your system's addressable memory (up to 16MB) and can run multiple sessions of *DisplayWrite* via the OS/2 session manager.

In true IBM software style, however, *DisplayWrite 4/2* is far from innovative. For example, though the program makes use of multiple execution threads for some tasks—such as spelling checking against more than one dictionary in one pass—you can't edit more than one document at a time without switching to a separate *DisplayWrite* session.

And though OS/2 provides means for separate sessions to communicate with each other, *DisplayWrite 4/2* doesn't take advantage of this ability at all. A particularly irritating example: you can neither edit nor view a document from the current session if the document is already being used in another session. A pop-up screen that reminds you which file you are editing in which open session would help.

Finally, PC Labs performance tests showed little over-

(continues on page 36)

HANDS-ON INDEX

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Photograph: Thom O'Connor

Symphony 2.0 Has Stronger WP Features

PC HANDS ON

BY MIKE FALKNER

Lotus Development Corp. has released Version 2.0 of *Symphony*, its popular integrated software package. While not a major upgrade, *Symphony* 2.0 does add some new features and eliminates the awkwardness of many existing ones.

Installing the new version isn't as easy as it should be. Copy protection is gone, but Lotus has added an initialization program that requires you to put your name and company name on the system disk before *Symphony* can be installed.

Two three-ring binders replace the old hardbound documentation. The How-to and Reference manuals now share a common index, and there's a new quick reference.

Many improvements focus on the word processing module. The spelling checker and text outliner previously available as add-ins are included with Version 2.0. *Symphony* now accepts hard tabs instead of changing them to spaces. Page breaks are shown in the vertical borders, and the page and line number are now printed in the control panel.

The new version adds shortcut keys for commonly used functions such as search (Ctrl-S) and format (Ctrl-F) and includes new macro keywords to go along with them. Search-and-replace now accepts wildcards, and you can select print attributes such as boldface and italic from a menu.

Significant changes to the program's functions include .DCA, .RFT, and SYLK format translation, making *Symphony* compatible with other word processors. On the spreadsheet end, *Symphony* minimizes recalculation time by changing only the cells that are affected by a modification. The new global zero suppression feature displays and prints blanks when a cell equals zero.

A new network feature prevents network users from simultaneously updating the same spreadsheet.

Two changes to the database function are the higher field limit (up from 32 fields to 256 fields) and a new Field edit command that lets you insert, delete, or move fields in an existing form.

Although the minimum $95 upgrade cost seems steep, this new version makes *Symphony* a little easier to use and saves you the cost of the spelling checker and outliner. Unless, of course, you already bought them with the last version. PC



Symphony 2.0 displays page and line numbers at the top of the page. Page breaks are indicated by special characters in the margin

PC MAGAZINE FACT FILE

***Symphony*, Version 2.0**
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500
List Price: $695; $95 for upgrade from Version 1.1/1.2 to 2.0; $150 for upgrade from Version 1.0/1.0t.
Requires: 384K RAM, DOS 2.0 or later.
In Short: Welcome changes have been made to *Symphony*'s word processor, and other functions have been fine tuned. Not copy protected.

CIRCLE 437 ON READER SERVICE CARD

Slimmer Metro Eats Less RAM

PC HANDS ON

BY DAVID DEJEAN

Even the most ardent fans of *Lotus Metro*, the desktop manager TSR utility from Lotus Development Corp., grumble about its gourmand RAM appetite. Especially when they have to unload the program (and its *Lotus Express* communications accessory) to use *Lotus 1-2-3* or a word processing program.

A new version of *Metro* now addresses the RAM problem and adds some minor improvements as well.

The old *Metro* reserved 120K to 140K of memory for itself and its accessories. The new version can run in 64K (80K with *Express* installed). A new memory-management facility, called the Swapper, is responsible. It installs the *Metro* kernel in memory, then borrows additional RAM from the system as needed to load accessories and associated data on-disk. You can set the amount of RAM to allot to *Metro*; the settings are easily changed from the overall menu.

New tweaks to *Metro* include VGA compatibility and 5¼- and 3½-inch disks in every package. There aren't any new utilities; it's hard to imagine what could be added to the dozen functions already in *Metro*—the notepad, phone book, keyboard macros, appointment calendar, file manager, and all the rest. The calculator has been updated to match the layouts of the 101-key IBM Enhanced keyboard and the keyboards of some laptops (*Metro* is bundled with several models of Toshiba laptops). PC

PC MAGAZINE FACT FILE

***Lotus Metro*, Version 1.1**
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500
List Price: $85; $35 for registered owners of *Lotus Metro*, Version 1.0, and *Lotus Express*.
Requires: 64K RAM (80K if running *Express*), DOS 2.0 or later.
In Short: The biggest news with *Lotus Metro*, Version 1.1, is its reduced memory requirement. Other improvements are minimal. Not copy protected.

CIRCLE 436 ON READER SERVICE CARD

Compaq OS/2

(continued from page 33)

Selector with the menu option Install MS Operating System/2. If necessary, the installation program will partition and format your hard disk. Otherwise, OS/2 will replace DOS on a hard disk currently used for DOS. Compaq's version of MS OS/2 requires about 2½MB of hard disk space plus another ½MB for a virtual memory swap file.

During installation, the installation program is copied to the hard disk and renamed CONFIG.EXE. When you later boot OS/2 from the hard disk, this program appears on the Program Selector menu with the description Modify Configuration File. This allows you to change your CONFIG.SYS file without directly editing it. It's a feature not included in IBM's OS/2, and in theory it's a good one. However, the program does not work correctly if you move some OS/2 files to directories other than the ones in which they were originally installed.

Another feature in Compaq's MS OS/2 that's not in IBM's OS/2 is disk caching. IBM's OS/2 supports disk caching only for PS/2 machines and not for the PC AT or PC-XT Model 286. Compaq's OS/2 supports disk caching for all Compaq machines.

The biggest disappointment to some Compaq owners will be the lack of support for hard disk partitions greater than 32MB. (Compaq's MS-DOS 3.31 supports hard disk partitions up to 512MB.) Compaq's OS/2 does not recognize these large partitions. If your primary hard disk partition is greater than 32MB, you must back up the files and delete the partition under DOS using the DOS FDISK program before you can install OS/2.

Compaq's OS/2 creates the same directories as IBM's OS/2 and leaves almost as many files in the root directory. This is not necessary. Microsoft has devised an alternative directory organization for OS/2 that requires fewer files to be stored in the root directory. But this alternative directory organization is not an option in Compaq's installation procedure.

Microsoft has also devised a technique to install both MS OS/2 and DOS on a hard disk, allowing you to choose one at boot time. Compaq did not include this feature. If you install Compaq's MS OS/2 on your hard disk and need to boot DOS, you must boot DOS from a floppy disk, just as with IBM's OS/2.

This is puzzling. With some recent products (such as the Deskpro 386/20), Compaq has introduced bold hardware design. But in its adaptation of MS OS/2 1.0, it has chosen to be excessively IBM compatible in certain areas where compatibility is simply not necessary.

Fortunately, everyone who is selling OS/2 1.0 gets an opportunity to right the wrongs in October, when OS/2 1.1 is scheduled to ship. Compaq's MS OS/2 1.0 comes with an OS/2 1.1 upgrade card. I hope that Compaq owners who mail it in will be pleasantly surprised by Compaq's adaptation of OS/2 1.1. PC

In its adaptation of MS OS/2 1.0, Compaq has chosen to be excessively IBM compatible in certain areas where compatibility is simply not necessary.

PC MAGAZINE FACT FILE

MS Operating System/2 Standard Version 1.0
Compaq Computer Corp.
20555 FM 149
Houston, TX 77269
(713) 370-0670
List Price: $325
Requires: 1.5MB RAM (2MB recommended), Compaq 80286- or 80386-based computer, one high-density floppy disk drive and hard disk.
In Short: Compaq's version of MS OS/2 is easy to install. However, despite some features not in IBM's OS/2, Compaq's OS/2 is excessively and disappointingly IBM compatible.

CIRCLE 453 ON READER SERVICE CARD

"MS" vs. "IBM": Déjà Vu with OS/2

For years DOS users have wondered and worried about the differences between PC-DOS (the version of DOS that IBM sells) and MS-DOS (the version of DOS that Microsoft licenses for sale by computer manufacturers other than IBM). But times have changed, and the concerns about the differences between MS-DOS and PC-DOS are now part of history. Today we must instead wonder and worry about the differences between IBM OS/2 and MS OS/2.

OS/2 was developed under the IBM/Microsoft Joint Development Agreement. IBM sells OS/2 (officially called IBM Operating System/2 Standard Edition 1.0) on a retail level to owners of IBM PC ATs, PC-XT Model 286s, and PS/2 Models 50 and above. Microsoft licenses OS/2 to OEMs (original equipment manufacturers such as Compaq) who adapt it for their own machines and sell it on a retail level. These OEMs call it MS Operating System/2 Standard Version 1.0, or MS OS/2 for short. IBM doesn't have to call its version MS OS/2 because . . . well, because it's IBM.

Contrary to some earlier rumors, IBM OS/2 and MS OS/2 are basically the same operating system. For the most part they consist of identical code. The differences are of a nature that should not affect application programs.

But there are differences. The biggest is the OS/2 Program Selector, which is the full-screen menu-driven program that greets the OS/2 user after OS/2 boots.

The original OS/2 Program Selector developed by Microsoft and distributed as part of the original OS/2 Software Development Kit was simple and primitive. IBM developed a more sophisticated Program Selector but did so outside of the IBM/Microsoft Joint Development Agreement. IBM's Program Selector is available only as part of IBM's OS/2.

In order to allow other computer manufacturers to sell MS OS/2 with a Program Selector that worked the same as IBM's, Microsoft cloned IBM's Program Selector. Amazingly, Microsoft's Program Selector requires about 128K less disk space than IBM's (who said Microsoft can't write small programs anymore?). Because the Program Selector is basically an OS/2 application, you can use IBM's Program Selector under MS OS/2 and Microsoft's Program Selector under IBM's OS/2.

The other major difference between IBM OS/2 and MS OS/2 is the installation program. IBM uses its own installation program. An OEM who licenses MS OS/2 can include Microsoft's installation program or write its own. Microsoft offers several other options that OEMs can choose to include in their adaptations of OS/2. These include disk caching (not supported by IBM's OS/2 for the PC AT and PC-XT Model 286), an alternative subdirectory organization (better than IBM's), and a "dual-boot" option to keep OS/2 and DOS on the same hard disk (not supported by IBM's OS/2).

None of this should affect the OS/2 application program interface. According to both Microsoft and IBM, applications for OS/2 1.0 should run the same under IBM's OS/2 and MS OS/2.—**Charles Petzold**

DisplayWrite 4/2

(continued from page 33)

all speed difference between *DisplayWrite 4/2* under OS/2 and *DisplayWrite 4* under DOS. This is surprising, since OS/2 applications generally promise faster operation than their DOS counterparts. It's also annoying, since *DisplayWrite* is slow to begin with.

Sluggishness aside, however, *DisplayWrite 4/2* offers a handful of long-overdue features that may make the upgrade worthwhile.

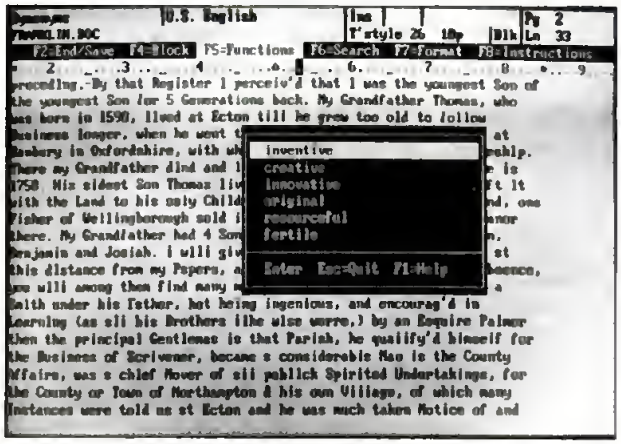
For starters, IBM seems to have finally acknowledged printers that don't sport an IBM logo. *DisplayWrite 4/2* adds 13 non-IBM printer drivers, including support for Epson's FX-286, LQ-1000, and GQ-3500; the Diablo 630; and HP's LaserJet line.

DisplayWrite 4/2 also adds snaking text columns, limited thesaurus ability, line and block sorts, and the ability to copy the format of one document to another. You can also preview a formatted version of the page you're editing and browse a document other than the one you're editing.

IBM declined to say whether these enhancements would be implemented in a future DOS version.

All in all, version 4/2 should provide an attractive, pain-free upgrade path to OS/2 for users entrenched in the *DisplayWrite* interface. The program looks and feels much the same as *DisplayWrite 4*.

Even with the advantages it gains from OS/2, however, *DisplayWrite 4/2* can't compete with the top-selling word processors in ease of use, features, or speed. If you've gone this long without using *DisplayWrite*, don't start now.



DisplayWrite 4/2, an OS/2 version of IBM's word processing application, offers a synonym list. Pressing Enter copies the highlighted synonym into text.

FACT FILE

DisplayWrite 4/2
IBM Corp.
Old Orchard Rd.
Armonk, NY 10504
(800) 447-4700
List Price: $495; upgrade, $125 ($100 per additional upgrade license).
Requires: 2MB RAM, one 1.44- or 1.2MB floppy disk drive, 20MB hard disk, 286- or 386-based PC, OS/2.
In Short: An OS/2 version of IBM's clunky *DisplayWrite* word processor. Not copy protected.

CIRCLE 452 ON READER SERVICE CARD

Smaller, Faster PostScript Printer from QMS

PC HANDS ON

BY MITT JONES

The QMS-PS 800 Plus offered a compromise for those who wanted the graphics pizzazz of a PostScript printer but needed the widespread acceptance of Hewlett-Packard's LaserJet Plus. Introduced last year, the printer functioned primarily as a PostScript printer but boasted emulations of the LaserJet Plus, Diablo 630, and HP 7475 Plotter as well.

Now QMS has unveiled a new incarnation of the same idea. The QMS-PS 810 packs the abilities of its predecessor, including the three emulations, into a smaller, faster package.

Based on the downsized Canon SX engine, the 810 gets its PostScript smarts from a Personality module that slides into the base of the chassis. One megabyte of ROM holds Version 47.0A of Adobe's PostScript plus the same, ever-popular 35 fonts included with Apple's LaserWriter Plus. Two megabytes of RAM (upgradable to 3) provide storage for the page buffer and font cache.

A Motorola 68000 processor, running at a speedy 16 MHz with one wait state, handles the translation from PostScript commands to the corresponding bit-mapped images.

You get your choice of three connectors for attaching the 810 to your system—9-pin and 25-pin serial ports and a Centronics parallel. A thumb-wheel switch on the rear of the chassis lets you specify which port and which printer emulation you'll be using.

Our first evaluation unit went comatose before we could finish running our benchmark tests, refusing to print even the start-up page. The second unit QMS sent to us performed flawlessly, however, and delivered impressive PostScript output at impressive speeds.

Attached to an 8-MHz IBM PC AT via the parallel connection, the 810 nearly equaled the field-leading speed of QMS's JetScript, a board that brings PostScript capability to the LaserJet series II (see First Looks, page 48, *PC Magazine*, April 26, 1988). PC Labs benchmark tests clocked the 810 at 6.5 pages per minute initially and 7.4 ppm once the printer loaded its font cache. The 810 printed our four-page newsletter in an impressive 6 minutes and 47 seconds the first time and in 4 minutes and 40 seconds once fonts were cached.

But the 810's performance wanes a bit when you emulate another printer—at least in comparison with the printer you're trying to emulate. That's because the 810 is subject to some of the speed limitations of PostScript when emulating non-PostScript printers. For instance, it must still translate fonts from outline to bit-mapped form before the font can be used. PC Labs benchmark tests clocked the HP LaserJet Plus emulation at 6.5 ppm—a page per minute slower than the real thing. The LaserJet Plus emulation clocked in at 7.5 pages per minute once the fonts were loaded into the cache.

All things considered, the QMS-PS 810 rates as a good buy. The $5,495 price gets you a PostScript printer with the added bonus of the three emulations. But if the LaserJet emulation is extremely important to you, you might be better off with QMS's JetScript. Coupled with a LaserJet series II, the JetScript also offers PostScript and LaserJet capability but at greater speeds and lower cost.

FACT FILE

QMS-PS 810
QMS Inc.
One Magnum Pass
Mobile, AL 36618
(205) 633-4300
List Price: $5,495
In Short: A Canon SX–based PostScript printer that includes HP LaserJet Plus and Diablo 630 emulation.

CIRCLE 458 ON READER SERVICE CARD

Photograph, Thom O'Connor



DESK-LINK Makes Disk and Printer Sharing a Snap.



Now there's one easy solution that can have your two desktop computers sharing files, a printer, even a single hard disk, all with just a snap.

DESK-LINK® from Traveling Software, the makers of the award winning LAP-LINK.®

DESK-LINK allows you to connect two IBM or compatible computers, including the new PS/2 and laptops, with just phone wire and DESK-LINK software. It even comes with a pop up "talk box" function for sending messages back and forth between the connected computers. Even while using your favorite software. DESK-LINK is complete too; including both 5¼ and 3½ inch diskettes, universal connectors, 25′ of RJ11 standard telephone cabling and documentation.

Best of all, DESK-LINK installs painlessly in minutes using your computer's serial port, with no add-in board required. It has incredible communication speeds of over 115,000 baud, and it's even compatible with most "big" networks!

So if you've been looking for a fast, inexpensive way for your two computers to share files, printers, or hard disks, snap up DESK-LINK today. Available at your local computer store for only $169.95—that's less than $85 per computer! For more information call: 1-800-343-8080 or 1-206-483-8088.

Traveling Software

Traveling Software, Inc. • 19310 North Creek Parkway • Bothell, WA 98011

CIRCLE 222 ON READER SERVICE CARD

Feature-Packed Desktop Organizer Lets You Take Charge of Your PC

PC HANDS ON

BY JONATHAN MATZKIN

Take Charge, from Departmental Technologies, is a new pop-up organizer that integrates traditional tools with features not often found in similar packages. It lacks the slickness and flexibility of Borland's *SideKick Plus*, but it offers such a barrage of features (especially for its introductory $69 price tag) that it's definitely worth a close look.

Aside from its rich features and reasonable price, *Take Charge* has another charm. Since all of its applications are swapped in and out of RAM, only the program's basic 23K kernel is continuously resident. That's less than half the memory *SideKick Plus* requires.

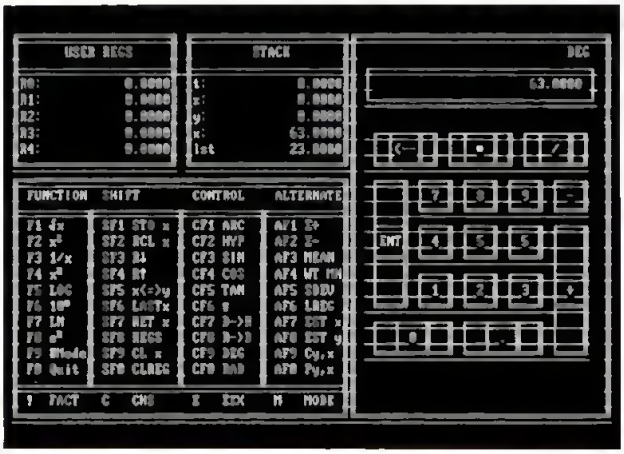
When you hotkey into *Take Charge*, you face an uncluttered function key menu of applications. Some of these, like the appointment calendar, phone dialer, notepad, and DOS shell, are familiar. But *Take Charge* offers a few things you probably haven't seen tied to a hotkey.

Tapping F5 from the main menu, for instance, brings up a group of disk utilities like those found in *The Norton Utilities*. There is a file recovery utility for those unpleasant DEL *.* episodes and a format recovery utility for cleaning up after really nasty spills. A disk optimizer is also included.

Take Charge also has a calculator that you can't get with *SideKick Plus*. It's an elegantly laid out RPN calculator that shows the contents of the memory stack on-screen. The contents of user-accessible memory registers are visible as well. A second calculator emulates an adding machine.

Tapping F9 from *Take Charge*'s main menu brings up a set of system utilities. A keyboard lock lets you specify a two-key access code. The lock isn't a serious security device, but it's useful during quick trips to the watercooler. The "command stack" feature remembers commands that you type at the DOS command line, up to a maximum of 256 characters. You can then review them, one at a time at the DOS prompt, using the cursor keys.

Take Chorge isn't a feature-for-feature clone of *SideKick Plus*. It has some novel features of its own, however, that make it a helpful, reasonably priced desktop companion. PC



Take Charge *features a pop-up RPN logic calculator. The contents of the calculator's memory stack are visible during calculations.*

PC MAGAZINE FACT FILE

Take Charge
Departmental Technologies Inc.
131 Washington St.
Lodi, NJ 07644
(201) 473-2400
List Price: $69 (introductory price).
Requires: 256K RAM, hard disk drive or RAMdisk, DOS 2.0 or later.
In Short: A value-priced desktop organizer that offers an unusual variety of useful tools. Not copy protected.

CIRCLE 454 ON READER SERVICE CARD

Choice Words Utility Integrates Extensive Dictionary, Thesaurus

PC HANDS ON

BY JONATHAN MATZKIN

Choice Words, from Proximity Technology, is a powerful combination dictionary/thesaurus that takes up less space than some other packages and offers the flexibility that writers need.

Choice Words requires about 1.5MB of disk space, which doesn't seem so bad when you consider that the program provides 80,000 dictionary definitions and 470,000 synonym responses to 40,000 thesaurus entries. *Choice Words* needs 256K RAM to run, including 100K of free RAM.

The program is designed to work with most major word processors and can also be popped up over other software, including DOS.

You can pick up a word at the cursor, or you can type a word into the query box that appears when you hotkey into *Choice Words*.

Once a word has been queried in the dictionary, *Choice Words* displays a definition screen.

Any word in the definition can be cross-referenced; you simply place the cursor on the word and press Enter. *Choice Words* displays a new definition screen that corresponds to the cross-referenced word.

A separate hotkey pulls up the thesaurus, which, like the dictionary, allows for considerable cross-referencing. You can freely browse among linked synonyms and meanings.

Choice Words could present problems to RAM-starved systems, but users with the appropriate equipment will revel in the power of having all that information, quite literally, at their fingertips. PC

PC MAGAZINE FACT FILE

Choice Words
Proximity Technology Inc.
3511 NE 22nd Ave.
Fort Lauderdale, FL 33308
(800) 323-0023
List Price: $99
Requires: 256K RAM (100K free), hard disk drive or one 1.2MB floppy disk drive and one 360K 5¼-inch floppy disk drive, DOS 2.0 or later.
In Short: A dictionary and thesaurus at the touch of a hotkey. Both modules feature extensive cross-referencing. *Choice Words* devours less disk space than some other dictionary packages. Not copy protected.

CIRCLE 456 ON READER SERVICE CARD



Disk Optimizer™. The original un-fragment software now has un-format. Un-believable!

It's still the safest, most effective way to put the zip back in hard disk performance.

For more than two years now, Disk Optimizer has helped PC users everywhere safely restore and maintain the smooth, slick, fast performance of their hard disks.

And now there's a new and improved Disk Optimizer that un-fragments files even more effectively. And includes enough additional disk management tools to make it one of the best software values anywhere.

So, who needs Disk Optimizer, anyway?

Simply everyone who owns a hard disk and relies on the speed and convenience it gives them.

That's because DOS is constantly slowing your hard disk down. It does it by breaking files up into pieces. Storing different chunks in different places. And that makes everything slower – loading, sorting, retrieving, backing up – because your hard disk has to chase all around to read and write different pieces of your file.

Disk Optimizer restores the speed of your hard disk by putting files back together in one contiguous piece – where they belong.

Disk Optimizer is absolutely, positively "disaster proof."

It's sad but true. Some other un-fragmenting software could lose your data if something goes wrong in the process. Like a routine reading or writing error. Or even a power failure.

But have no fear with Disk Optimizer. Nothing will go wrong because nothing *can* go wrong. Even if you yank the plug from the wall in the middle of the program. It's because only Disk Optimizer copies each file, piece by piece, then checks the newly un-fragmented version for completeness. Only then does it go back and erase the fragmented version. Not power spikes, disk failures or DOS errors – not even earthquakes – can cause data loss. And only Disk Optimizer makes you that promise. So why trust your disk to anyone else?

It's like a precision tune-up for your disk.

In addition to un-fragmenting, Disk Optimizer also lets you quickly choose the optimum layout for your disk. So your most-used files have the fastest access. And program and other unchanging files can be permanently un-fragmented and set aside on their own area on the disk.

The simple menu makes it a snap.

Un-format – one of the powerful new reasons to buy Disk Optimizer

Oops! Make a simple mistake at the keyboard and you could wipe out your hard disk with a DOS Format command. But don't worry. "Un-format" will recover your entire disk, and all your data, in just moments. It's included with your new Disk Optimizer.

Plus, you get the new "Analyze" program with a graphical display that shows your disk's condition so you'll always know when it's time to optimize again. You also get "Sorts" for organizing directories for the best appearance and sequence. "Findfile" for searching out hard to find files. "Delfile" for locating and erasing unwanted files. "Lock" and "Unlock" for file security. And more.

You could spend hundreds on other utilities and still not get all the functionality packed into Disk Optimizer at no extra charge.

Use it once and you'll discover what nearly 200,000 users already know – $69.95 is a small price to pay for the speed, convenience and safety you get only with Disk Optimizer.

Look for the new Disk Optimizer at software dealers everywhere. Or order directly from SoftLogic Solutions by calling us toll-free.

Just a few of Disk Optimizer's rave reviews:

Selected PC Magazine's "Best Of The Best" utilities.
– June 1987

"I find Disk Optimizer excellent. Disk access, even at 4.77MHz, is much faster. And loading 100 Fontasy fonts now takes seconds."
– Elizabeth Joan Doyle, Indiana

"I feel this is essential software for anyone with a hard drive."
– D. Sorenson, Texaco, California

"Easy to install, use, and most importantly, it works!"
– Dan Neilsen, General Electric Information Systems, NY

Disk & Optimizer $69.95

SOFTLOGIC SOLUTIONS

SoftLogic Solutions, Inc.
One Perimeter Road
Manchester, NH 03103
800-272-9900 (603-627-9900 in NH)

Call 800-272-9900

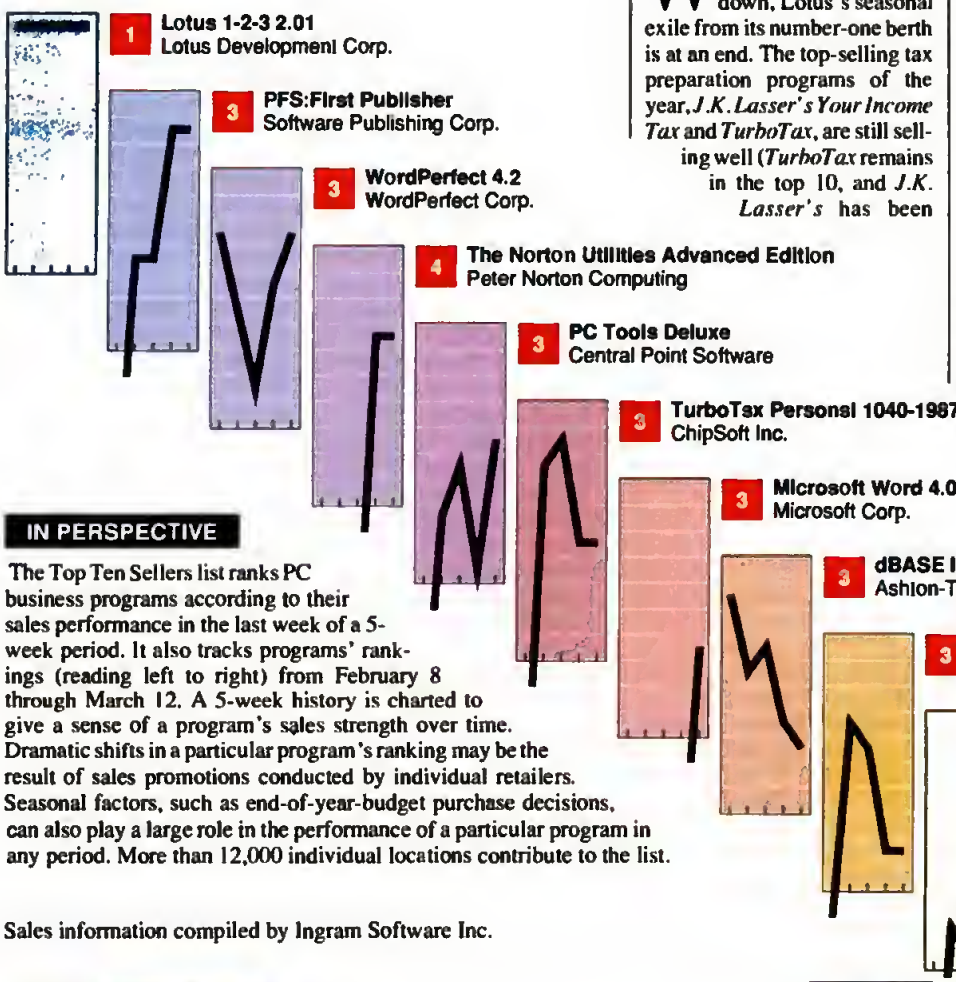
1-2-3 is a registered trademark of Lotus Development Corporation

#6

CIRCLE 334 ON READER SERVICE CARD

PC MAGAZINE PIPELINE

Top Ten Sellers



1 Lotus 1-2-3 2.01
Lotus Development Corp.

3 PFS:First Publisher
Software Publishing Corp.

3 WordPerfect 4.2
WordPerfect Corp.

4 The Norton Utilities Advanced Edition
Peter Norton Computing

3 PC Tools Deluxe
Central Point Software

3 TurboTax Personal 1040-1987
ChipSoft Inc.

3 Microsoft Word 4.0
Microsoft Corp.

3 dBASE III Plus 1.1
Ashton-Tate Corp.

3 PFS:First Choice 2.0
Software Publishing Corp.

10 Quicken 2.0
Intuit

Rankings are based on net sales by unit; returns are subtracted from gross sales.

Sales information compiled by Ingram Software Inc.

IN PERSPECTIVE

The Top Ten Sellers list ranks PC business programs according to their sales performance in the last week of a 5-week period. It also tracks programs' rankings (reading left to right) from February 8 through March 12. A 5-week history is charted to give a sense of a program's sales strength over time. Dramatic shifts in a particular program's ranking may be the result of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year-budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

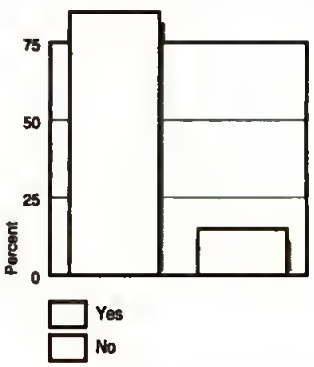
With tax season winding down, Lotus's seasonal exile from its number-one berth is at an end. The top-selling tax preparation programs of the year, *J.K. Lasser's Your Income Tax* and *TurboTax*, are still selling well (*TurboTax* remains in the top 10, and *J.K. Lasser's* has been hovering between 10 and 20). But clearly, their moment is past.

A question that we've raised before seems appropriate once again. Can *Lotus 1-2-3* continue to fend off the challengers to its standard-setting throne? *Microsoft Excel* and Borland's *Quattro* have been selling well, both of them ranking between 10 and 20 for a number of weeks. But Lotus is not rushing its powerful response, Release 3, which was planned for June and Lotus now says won't be out until the end of the year.

The delay is disappointing since work on Release 3 was far along

SURVEY

Do you use a database manager at work?



Much of the work that goes into planning *PC Magazine* product roundups is deciding which features need to be tested and the best way to run tests, but we also ask readers to tell us which products are important to them. We aim to cover every product we can find, but checking with readers assures us that we won't miss anything important.

The results of this survey on databases show two things: a lot of people use *dBASE*, and even more use something else. One of the more amusing findings (but one that doesn't surprise us) is that one of the top five database managers is a spreadsheet. In questions not printed here, we asked people to list the DBMS used most commonly in their office overall (as opposed to their own favorite), and *Lotus 1-2-3* jumped to number 2. And when we asked people who had changed to a new DBMS which DBMS they had given up, *1-2-3* was again number 2 (*dBASE* was first).

Among the 78 programs that people cited in the "other" category (those that earned less than 1 percent total responses) were *Nutshell*, *Ability Plus*, *Enable*, *Informix-SQL*, and *KnowledgeMan*.

when we sat down with it in mid-March. Lotus is now struggling to optimize the code for speed and size.

1-2-3 Undo

The new undo feature will make the upgrade essential even for those not looking for anything new. Reversing a command (including deletions) will be simple.

Release 3 will also have a buffer of about 256 characters (the number may change) that will let you auto-record macros or avoid repetitive typing without using macros, since you'll be able to flush the buffer without going through the extra effort of setting up a range to store the macro.

Of course, Release 3 will be three-dimensional. The good news is that its approach to multilayered spreadsheets (see photo) should make the concept simple for everyone to understand and make macro maintenance far easier than it is now.

Although Lotus may opt to use different terms later, it intends to make a distinction between a *spreadsheet* and a *file*, terms that are interchangeable right now. In Release 3, a file will have a capacity of up to 256 spreadsheets, each of which will be labeled with letters of the alphabet (using double letters beyond 26, of course). Thus, a file will have cells A:A1, B:A1, and C:A1, but a spreadsheet itself will keep the same cell addresses now in use.



An early look at *Lotus 1-2-3*, Release 3's Perspective view of three spreadsheets.

If you want to use data stored in a separate file, you'll be able to insert the filename and range in a formula; Release 3 will then read the data from disk and use it in the active formula.

Macros Can Have a Spreadsheet of Their Own

Typically, you'll keep macros in their own spreadsheet (sheet A, perhaps). If you keep monthly records, you'll probably want to set up a separate spreadsheet for each month. You'll be able to cycle through sheets with Ctrl-PgUp and Ctrl-PgDn commands. There will be a Perspective view, but it will be limited to a static view of three sheets, each getting an equal horizontal slice of the display (see photo). You'll be able to look at two different sheets together, using the window split-screen command, but no more.

What About Add-ins?

Programs that attach themselves to *1-2-3*, Release 2's add-in manager will require major changes. Release 3 will support add-ins via a new Lotus Extended Applications Facility (LEAF) tool kit. Lotus has not yet distributed the LEAF tool kit, so don't count on getting any of those upgrades immediately.

All This and OS/2

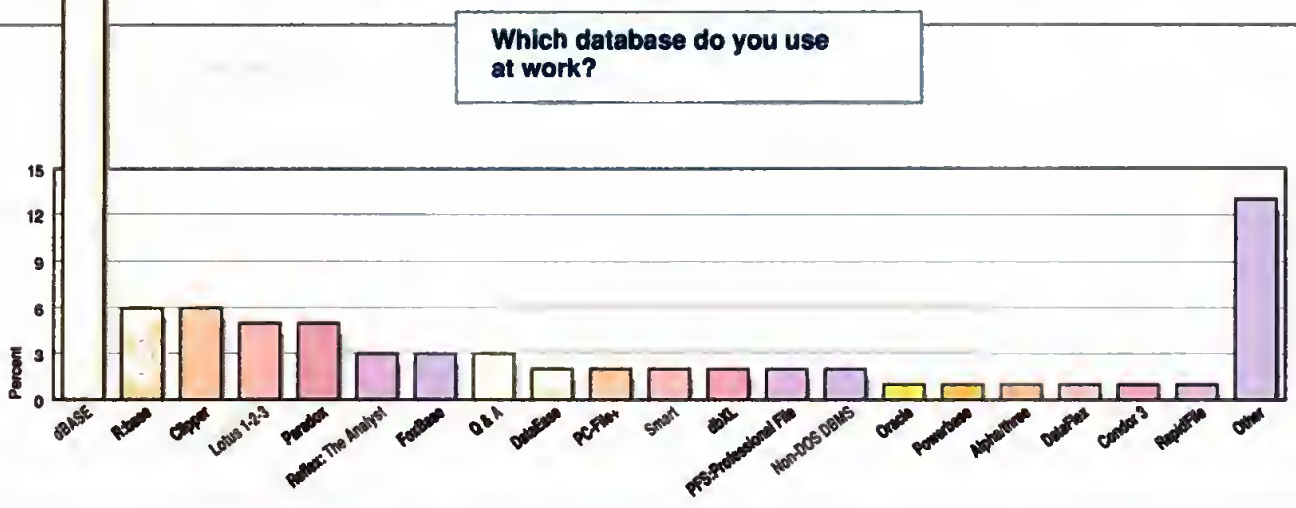
The real beneficiary of Release 3 will probably turn out to be OS/2. Since Lotus will ship a DOS and OS/2 version of Release 3 in the same box, by the end of this year hundreds of thousands of people will suddenly have a reason to run OS/2, if for no other reason than to keep *1-2-3* always a key combination away.

—Gus Venditto

CORRECTIONS

In reporting on the competition between Microsoft and Borland for the hearts and minds of programmers (First Looks, page 41, *PC Magazine*, March 29, 1988), we erred by overlooking one of Borland's Turbo C releases.

In fairness, we also should have made it clear that there were no bugs in the Turbo C compiler, only in the Release 1.0 libraries. Borland fixed the problems in its libraries in Release 1.1. Release 1.5 improved compiler performance and added graphics libraries.



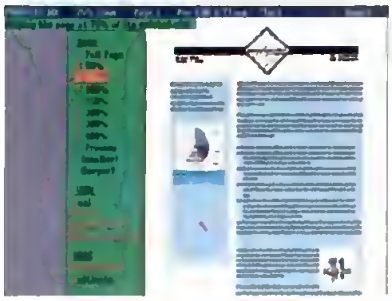
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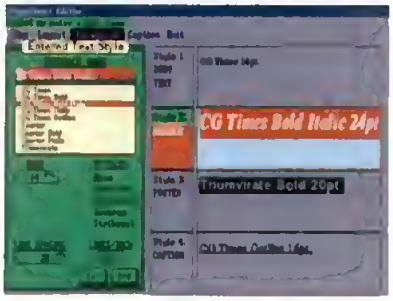
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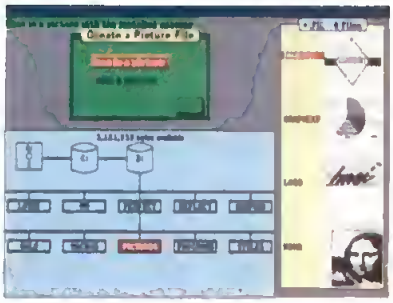


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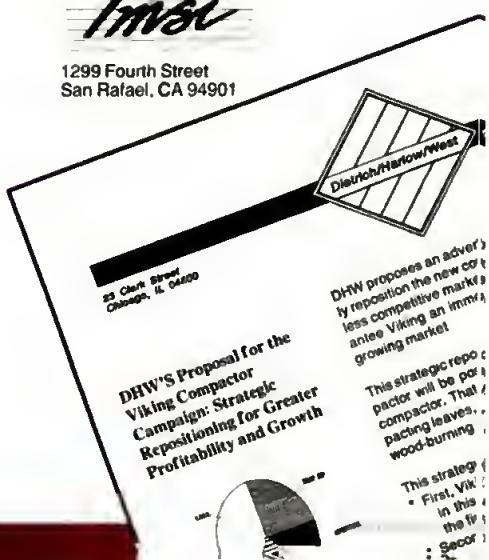


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Procomm Strengthens Its Script Language, Adds BBS Features

PC HANDS ON

BY GUS VENDITTO

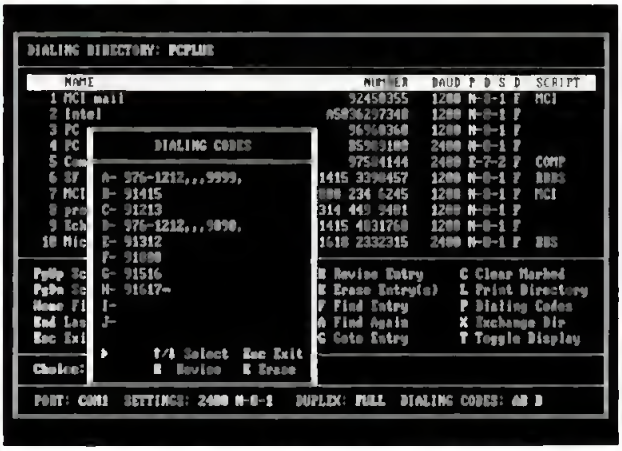
PC Magazine has heaped plenty of praise on *Procomm* over the years: we called it "a classic in the making" early on, we selected it as an Editor's Choice, and we said it was one of the "Best of the Year" in 1986.

Procomm was discovered years ago in a typical shareware experiment: downloaded from a bulletin board, unsqueezed with ARC, and tested under a skeptical eye. It quickly became an office standard and a personal favorite.

When *Procomm Plus* arrived here recently, it drew even more skepticism than any of the earliest versions. The shareware mystique was missing: *Procomm Plus* was professionally packaged and shrink-wrapped. The sense of adventure was missing; the 340-page manual even had installation instructions. *Procomm* has gone commercial. Is this the death of a classic?

No, thank heaven. It's the beginning of adulthood.

The speed and fast-access design of the early versions are still here: every change is a welcome extension of the old.



Phone number entries in Procomm Plus *can be simplified with dioling codes; assign on oreo code or o Sprint occess code to one of the ten choices.*

The script language adds math functions and disk operations to an already powerful set of commands. You can create script files effortlessly by turning on the keystroke recorder.

You can still readily move to DOS or an editor while on-line. Now you can assign two other programs for instant loading (I keep *Lotus 1-2-3* on Alt-J).

The greatest improvement of all is a fairly substantial bulletin board facility. Version 2.4 let you set up a host mode to allow remote file viewing, but you were limited to transferring text files using DOS redirection. *Procomm Plus* provides a host mode that offers file transfer in seven protocols (from familiar Xmodem and Kermit to the newly added Ymodem-G and Sealink). You can set a security level to restrict access to a single directory, or you can make the entire host system available.

Not everything is better. A few of the editing features are still awkward. You page through dialing directories and configuration options, instead of scrolling by line.

Most every aspect of the program is better, however. You can easily change dialing directories (not something you'd think was important until you see that the program comes with seven directories full of BBS numbers).

You can't even fault *Procomm Plus*'s publisher for abandoning shareware: it's continuing to distribute Version 2.4 on a try-first-pay-later basis. In fact, Version 2.4's real value may be as an advertisement for *Plus*: if you like the early version, you'll love the new stuff. PC

PC MAGAZINE FACT FILE

Procomm Plus
Datastorm Technologies Inc.
1621 Towne Dr.
Columbia, MD 65202
(314) 474-8461
List Price: $75; upgrade, $50.
Requires: 192K RAM, one disk drive, Hayes-compatible modem, DOS 2.0 or later.
In Short: A significant improvement to one of the best values in communications programs. Not copy protected.

CIRCLE 455 ON READER SERVICE CARD

File Compression Utility Expands The Capacity of Your Hard Disk

PC HANDS ON

BY JONATHAN MATZKIN

Hard disks are a bit like baby clothing. No sooner are they bought than they start to feel too small.

So a new software category has grown up around the need to squeeze more bytes onto PC hard disks. Joining Ashton-Tate's *Free Space* and SoftLogic's *Cubit* is Isogon Corp.'s *Newspace*, a new entry in the more-data-per-platter software competition.

Newspace compresses data files and leaves alone .COM and .EXE files. Unlike other compression programs, *Newspace* seeks to be completely transparent. You run it once when you install it, to compress files that already exist on your drive, and from then on the program functions automatically. Files are automatically compressed as they are written to disk.

There is no "virtual drive" metaphor for the location of the squashed files; directory listings for the affected drive are unchanged.

Nor is there a need to uncompress files that you want to distribute, because *Newspace* automatically expands files as they are written to floppy disks.

The package does not work with multitasking environments, such as *Microsoft Windows*, or in networking environments. PC

PC MAGAZINE FACT FILE

Newspace
Isogon Corp.
330 Seventh Ave.
New York, NY 10001
(212) 967-2424
List Price: $69.95
Requires: 256K RAM, hard disk drive, DOS 2.0 or later.
In Short: An extremely easy-to-use file compression utility with the ability to recover accidentally erased files. It can operate without user intervention after initial setup. Not copy protected.

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CIRCLE 206 ON READER SERVICE CARD

Quicksilver Update Improves Performance, Adds Network Support, Business Graphics

HANDS ON

BY GENE SMILGIEWICZ

Its close adherence to the Ashton-Tate standard has made WordTech Systems' *Quicksilver* the language compiler of choice for many programmers. The latest incarnation, *Quicksilver Diamond*, Version 1.2, provides improved performance, a C language interface, and support for business graphics, multidimensional arrays, and interrupt-handling commands. LAN support has also been enhanced by the release of *Networker Plus*, a companion product that provides an impressive list of network-oriented features. (A full review of *Networker Plus* will appear in a future issue.)

These improvements make *Quicksilver* a versatile language for applications development.

Producing an application with *Quicksilver* involves compiling *dBASE/Quicksilver* source programs into a "d-Code" object file, then creating an executable file with WordTech's d-Code linker. You can generate complex systems quickly through use of batch files and compiler/linker switch settings. After testing, you can create even faster standalone executable files by translating the d-Code files into machine code object files with WordTech's optimizer and then linking them using an assembly language object file linker like DOS Link or Phoenix Technologies' Plink86.

WordTech's approach offers speed and convenience. The use of intermediate d-Code shortens the test/edit/compile/link cycle. Only after an application is debugged and greater speed is required does the more lengthy process of generating standalone native code become necessary. You can also boost development speed by using *dbXL*, WordTech's *dBASE* interpreter clone. *dbXL* supports nearly all of *Quicksilver*'s extensions, making it possible to test programs before compiling and linking.

Another useful extension of the *dBASE* language provided by *Quicksilver* is the AutoMem option for Append, Clear, Insert, Release, Replace, Store, and Use commands. This removes most of the tedium involved in setting up and manipulating memory variable corollaries for nonmemo fields.

Quicksilver now offers a complement of tools for low-level programming. The CCall command allows you to integrate assembly language or the Lattice C–compiled routines in your applications. The DOSInt command allows easy access to DOS interrupts. In(), Out, and BitSet() provide the means to control and evaluate traffic through I/O ports. With the Set Event command, your applications can have background multitasking capability. Whenever the specified event occurs, such as input from a COM port, execution branches automatically to the user-defined function or binary routine designated in the On Event command.

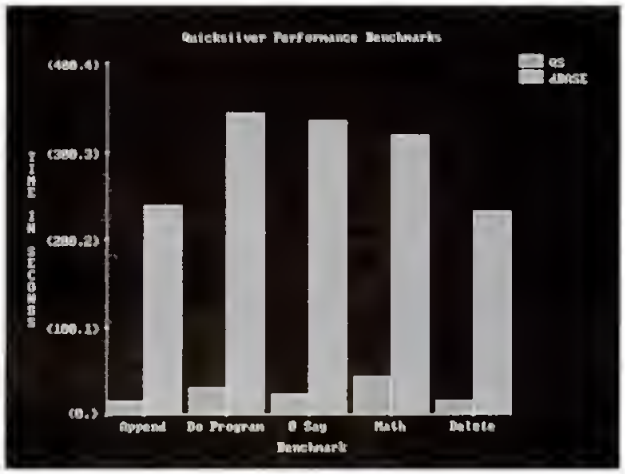
The *Quicksilver* package is rounded out with a good debugger, comprehensive documentation, numerous example programs, and several utilities for program editing, screen generation, and graph definition.

With *Quicksilver*'s window and menu commands, you can produce impressive user interfaces. You can define up to 99 windows, and each can be colored and addressed independently. The business graphics feature can produce good-looking pie, bar, stacked bar, line, scatter, and regression charts that can be printed, saved, displayed on-screen, or exported to a file compatible with *Ventura Publisher*.

I have only a few complaints about *Quicksilver*. Applications do not execute as quickly as with other *dBASE* compilers. Running an application involving complex expression evaluation, data retrieval, indexing, and screen I/O showed *Quicksilver* lagged well behind *FoxBASE* and *Clipper*, as well as an early *dBASE IV* beta.

Quicksilver inconveniently requires UDFs to be grouped together in a function file apart from other procedures. *dBASE III Plus* compatibility also perpetuates silly memory variable, field count, and procedure file limitations. .EXE files tend to be larger than *Clipper*'s.

If these drawbacks worry you, or if you're afraid to get involved with compilers in general, WordTech's laudable return policy should allay your concerns. You can return the product for a refund, as long as the operating disks remain sealed. The demonstration compiler supplied, which limits files to 16 or fewer records, is not only good for getting your feet wet but is a great tool for distributing your own limited demo applications.



The new business graphics feature in Quicksilver Diamond, *Version 1.2, will produce pie, bar, stacked bar, line, scatter, and regression charts*

FACT FILE

***Quicksilver Diamond*, Version 1.2**
WordTech Systems Inc.
P.O. Box 1747
Orinda, CA 94563
(415) 254-0900
List Price: $599; upgrade from Version 1.1 free if purchased after November 1, 1987—otherwise $75.
Requires: 512K RAM, two disk drives (hard disk recommended), DOS 2.0 or later. For networked applications: *Networker Plus* ($259), DOS 3.1 or later.
In Short: The only compiler that's both syntax and runtime compatible with *dBASE III Plus*, *Quicksilver* provides excellent interface, network, and graphics-oriented language extensions, though it executes more slowly than other compilers. Not copy protected.

CIRCLE 433 ON READER SERVICE CARD

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ORACLE, the world's most powerful relational database, now works from inside your Lotus 1-2-3 spreadsheet program. Familiar 1-2-3 menus guide you through creating, modifying and retrieving data in your database. You can even perform ORACLE database functions automatically using standard Lotus macros and formulas. The point is...



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> *"What a boon to the power spreadsheet user... most wish that [Lotus 1-2-3] could do more, store more, be updated more easily... with ORACLE running behind it, it can do all this and more."*
>
> Andrew M. Seybold, Publisher, *Outlook on Professional Computing*

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- A single command automatically creates new database tables from data in any existing worksheet.
- In update mode, changes in your worksheet become changes in your database. And if you make a mistake, you can...
- Undo changes. Or save your changes permanently in your database and worksheet.
- Share the same data in multiple worksheets, or even across a network of different computers with many users.

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Dear Oracle,

ORACLE for 1-2-3 · Oracle Corporation
20 Davis Drive · Belmont, CA 94002

Yes, I have an ☑ 80286/80386 PC running ☑ DOS 3.0+ and ☑ Lotus release 2.01. I also have ☑ 640KB of RAM, plus either ☑ 1MB of extended memory or I will reassign 1MB of my expanded (above-board) memory as extended memory. Please send me the database I already know how to use — the ORACLE database add-in for Lotus 1-2-3, on ☐ 5¼" or ☐ 3½" disks. Enclosed is my: ☐ check, or ☐ VISA ☐ MC ☐ AMEX credit card authorization for $199.*

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COMPANY _____ TITLE _____

STREET *(No P.O. boxes, please)* _____

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Paint Program Produces VGA Graphics

PC HANDS ON

BY JARED TAYLOR

Deluxe Paint II, from Electronic Arts, might be just the excuse you need to upgrade to a higher graphics standard. The razzle-dazzle drawing program pushes CGA graphics to their limits and shines in EGA mode. For real magic, try it on a VGA monitor.

Like all good paint programs, *Deluxe Paint II* gives you an endless variety of drawing tools: airbrushes, paintbrushes, fill patterns, curves, straight lines, and shapes.

Several features set *Deluxe Paint II* apart from the paint program crowd. It has 21 different levels of zoom, and you can use any drawing tool on the fat bits, not just the pixel editor. You can set on-screen vanishing points and draw figures in perfect perspective. You can create "stencils" to protect the foreground while you spray-paint a background. You can try something really daring on a separate "page" in memory and, if it works, transfer it to your masterpiece.



A Deluxe Paint II screen in EGA 16-color mode. Geometric shapes are easy to create and combine with realistic images. The program also supports VGA.

Deluxe Paint II is at its best with colors. You can tune each one and save a custom palette with every picture. You can soften color boundaries by letting the program smooth them with intermediate hues. You can even make the image cycle through a series of colors for a psychedelic effect.

Deluxe Paint II can swap files with *Windows Paint*, *PC Paintbrush*, Version 3.0, and *MacPaint* and has a utility to capture screens from other programs. It would be at home in any graphics studio but will end up wherever there are computers. In fact, it's so addictive, what it needs most is a command that throws a fake spreadsheet on the screen when the boss walks in. PC

PC MAGAZINE FACT FILE

Deluxe Paint II
Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
(415) 571-7171
List Price: $99.95
Requires: 640K RAM, one disk drive, graphics adapter, Microsoft-compatible mouse, DOS 2.0 or later.
In Short: A feature-packed paint program that supports VGA graphics. Not copy protected.

CIRCLE 434 ON READER SERVICE CARD

Two New Clip Art Programs Provide Ready-made Art for Business Graphics

PC HANDS ON

BY EDWARD MENDELSON

Clip art packages are a cheap, easy way to dress up bulletins and memos and a ready source of predrawn images that you can dump into desktop publishing programs.

Two new clip art series are Marketing Graphics' $99.95 *Publisher's Picture Paks* and Dynamic Graphics' series of $79.95 *DeskTop Art* packages.

Both packages include standard images of finance and industry, but the resemblance stops there. *Publisher's Picture Paks* leans heavily toward symbols of productivity: efficient office workers, stopwatches, piles of money, and smiling managers pointing at blackboards. *DeskTop Art* has more wit—devoting more space to employees buried under mail, terrified by computers, or collapsing over their desks.

With either series, you'll first need to shrink or convert most of the images before you can use them effectively. *DeskTop Art* uses ZSoft's standard PCX/PCC format, and the manual says you need ZSoft's *PC Paintbrush* to manipulate the images. But because the images are grouped into large omnibus files, rather than stored as small separate files, *DeskTop Art* slows *PC Paintbrush* to a glacial crawl. You'll wait 3 to 5 minutes for some of these files to load—only to find that most of the images are too big to be clipped in *PC Paintbrush*. You may need *Publisher's Paintbrush* instead.

Publisher's Picture Paks come in three formats: ZSoft's PCX/PCC, *Dr. Halo*'s CUT file, or the GEM/*Ventura* IMG format. (*Ventura* can also import the more widely used PCX/PCC format.) In early versions of the program most of the images were too big to edit in *PC Paintbrush* and required some complicated commands before they could be imported at all. By the time you read this, the images should have been properly downsized. PC

PC MAGAZINE FACT FILE

Publisher's Picture Paks
Marketing Graphics Inc.
401 E. Main St.
Richmond, VA 23219
(804) 788-8844
List Price: $99.95 each, $250 for all three.
Requires: *PC Paintbrush*, *Dr. Halo*, or *Ventura Publisher*.
In Short: Upbeat clip art for business graphics. Not copy protected.

CIRCLE 450 ON READER SERVICE CARD

DeskTop Art
Dynamic Graphics Inc.
6000 N. Forest Park Dr.
P.O. Box 1901
Peoria, IL 61656-1901
(800) 255-8800
List Price: $79.95 for each of eight packages.
Requires: *PC Paintbrush*.
In Short: Witty, wide-ranging collection of clip art and graphics designs. Not copy protected.

CIRCLE 451 ON READER SERVICE CARD

SHARP INTRODUCES...

OUR IMPRESSIVE NEW LAPTOP.

Presenting the ideal first laptop computer—the PC-4501. It packs the power of a full size IBM® compatible desk top. Yet, it sports features like 256 KB RAM. One 3½" 720 KB floppy disk drive. Flip-up, easy to read, Supertwist LCD display with extended battery life. It weighs only 10 pounds.

OUR MORE IMPRESSIVE NEW LAPTOP.

The PC-4502 is your classic portable computer, with all of the features many people will ever need. It offers 640KB RAM, backlit Supertwist LCD display for easy viewing in all light conditions, and dual 3½" 720 KB floppy disk drives for convenient software operation and storage.

OUR MOST IMPRESSIVE NEW LAPTOP.

The PC-4521 is the imposing choice for people who need extensive storage space. It offers a 20MB hard disk drive for super-convenient storage and portability, 640KB RAM, one 3½" 720 KB floppy disk drive, backlit Supertwist LCD display.

Sharp's family of PC-4500 computers are expandable to include 1.6MB RAM (with an EMS card) for advanced applications software, an EPROM card for building in your own applications, and an internal modem for easy communication. All are battery operated and designed to impress the socks off the most knowledgeable laptop user.

For more information on the Sharp family of laptops, see your Sharp dealer or call 1-800-BE-SHARP.



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CIRCLE 131 ON READER SERVICE CARD

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THE ST225

Proven reliability. That's the reason Seagate's 20 MB half-height hard disc drive is so popular, with over 3 million sold in less than three years.

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Seagate

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CIRCLE 474 ON READER SERVICE CARD

NEW ON THE MARKET

by Michael W. Muchmore

OTC's 2161 Printer Has 1,800-cps Speed With Two Printheads

Output Technology Corp. has developed a technique that enables its OTC 2161 printer to print two lines per pass, almost halving printing time.

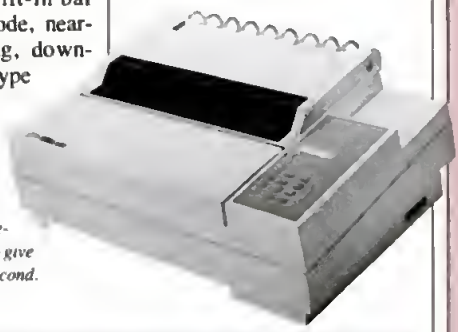
The $6,450 printer produces 600 lines per minute, or 1,800 characters per second.

The OTC 2161 includes two expansion slots, built-in bar codes, a graphics mode, near-letter-quality printing, downloadable fonts, eight type pitches, a 16-character LED, and 16 control keys. Serial, twinax, coax, and PrintNet interfaces are available.

The OTC 2161 emulates Printronix's P6080, Dataproducts' LB600, and Epson's FX-286e.

List Price: OTC 2161, $6,450. Output Technology Corp., E. 9922 Montgomery, #6, Spokane, WA 99206; (509) 926-3855.

CIRCLE **443** ON READER SERVICE CARD



Output Technology's $6,450 model 2161 prints two lines per pass with three-headed print mechanisms to give you 1,800 characters per second.

QMS Markets Color PostScript Printer

QMS claims it is the first company to offer a printer that capitalizes on PostScript's color graphics and text capabilities.

The $24,995 printer employs a 300- by 300-dot-per-inch Mitsubishi G650 color thermal transfer print engine. It comes with an external controller with RS-232, Centronics parallel, and RS-422 interfaces and cabling.

The controller is based around a Motorola 68020 microprocessor operating at 16.67 MHz and has 8MB RAM and 1MB ROM—enough to buffer an 11- by 17-inch page. It incorporates the latest PostScript code, with 35 resident fonts. A 20MB hard disk is included for font downloads or caches.

The ColorScript 100 takes four primary-colored films and melts square pixels onto thermal transfer paper or film, dithering or superpixeling to get intermediate colors. It takes a little under 1 minute to produce a page, according to QMS.

QMS rates the monthly output of the printer at 4,000 pages. **List Price:** QMS ColorScript 100, $24,995. QMS Inc., One Magnum Pass, Mobile, AL 36618; (205) 633-4300.

CIRCLE **442** ON READER SERVICE CARD



The 24,995 ColorScript 100 is the first color PostScript printer, according to its manufacturer, QMS.

VGA Graphics Boards from Tecmar and Orchid Provide Greater Compatibility

Early third-party VGA graphics boards have been plagued with incompatibility and product recalls. **Tecmar** says it waited until compatibility problems were ironed out before releasing its VGA boards. The Rexon subsidiary tested Tecmar's VGA boards by marketing them through OEMs before offering them under the Tecmar name.

Two versions are being offered: the Tecmar VGA and Tecmar VGA AD (advanced design, for higher resolution). Both models support the 17 IBM VGA modes, plus EGA, CGA, MDA, and Hercules graphics standards. The boards are equipped with 132-column text capability and drivers for *AutoCAD*, *Microsoft Windows*, and *GEM*. Both boards are built around the Tseng Labs VGA chip.

The $395 Tecmar VGA has 800- by 600-pixel resolution, while the $545 VGA AD gives 1,024 by 768 or Graphics Master 640 by 400 support.

Orchid Technology is shipping the Designer VGA, which furnishes both high- and low-resolution VGA modes.

"Multimode" gives the $445 add-in card's user a choice of from 640 by 480 resolution with 256 colors to 1,024 by 768 with 16 colors. Hence an upgrade in monitor or software won't necessitate a new VGA board.

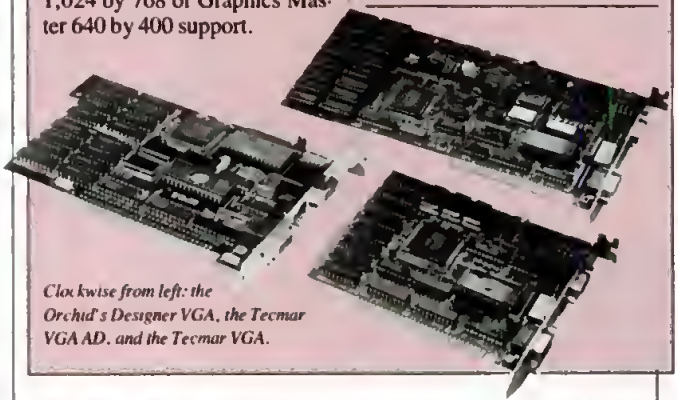
Orchid also claims register-level compatibility with EGA, CGA, MDA, and Hercules modes. The board is based around a Tseng Labs chip.

List Price: Tecmar VGA, $395; Tecmar VGA AD, $545. Tecmar Inc., 6225 Cochran Rd., Solon, OH 44139-3377; (216) 349-0600.

CIRCLE **440** ON READER SERVICE CARD

List Price: Orchid Designer VGA, $445. Orchid Technology, 45365 Northport Loop W., Fremont, CA 94538; (415) 683-0300.

CIRCLE **441** ON READER SERVICE CARD



Clockwise from left: the Orchid's Designer VGA, the Tecmar VGA AD, and the Tecmar VGA.

Two New Organizers: SuperProject Expert/2 For OS/2, GrandView

Symantec Corp. announced that its **Living Videotext** division would ship *GrandView*, its information management software, by March 31 of this year. The product will compete with Lotus's *Agenda*.

GrandView combines three main modules: Outline, Document, and Category. Each of these view modules is connected to the other two. The Outline view furnishes up to nine simultaneous windows of outline headlines. Headlines can be prioritized and can use different numbering schemes.

Word processing features like style sheets, formatting, block operations, headers and footers, tables of contents, and font selection are available in the Document view module.

(continues on page 52)

NEW ON THE MARKET

Organizers

(continued from page 51)

The Category view lets you define strings of information that it will then dump into a user-designated category each time the string occurs.

Computer Associates is shipping a project management package, *SuperProject Expert/2*, that is designed to run under OS/2 using the protected mode.

The software features extensive scheduling ability, interactive Outline and Work Breakdown structure, resource management, multiproject ability, costing, progress measurement, customizable reports, graphics, and word processing.

SuperProject Expert/2 can take advantage of OS/2's ability to multitask, to access up to 16MB of virtual memory, and to toggle between programs.

LAN capability is offered through LanPaks, which cost $695 each and permit three additional users.

List Price: *GrandView*, $295. **Requires:** 256K RAM, two disk drives, DOS 2.0 or later. Not copy protected. Living Videotext Division, Symantec Corp., 117 Easy St., Mountain View, CA 94043; (415) 964-6300.

CIRCLE **444** ON READER SERVICE CARD

List Price: *SuperProject Expert/2*, $795. **Requires:** 320K RAM, two 5¼- or one 3½-inch disk drive, 80-column monitor, 80-character-per-line printer, OS/2. Not copy protected. Computer Associates International, 1240 McKay Dr., San Jose, CA 95131; (408) 432-1727.

CIRCLE **445** ON READER SERVICE CARD

HOT PROSPECT

ISi Optical WORM Disk Drives Break the Gigabyte Storage Barrier

Information Storage Inc., of Colorado Springs, has announced an internal optical WORM drive that delivers 1.2 gigabytes of mass storage memory, and an external subsystem with twice that amount.

The internal ISi 525GB and the external ISi 525GBX use double-sided 5¼-inch removable optical media that holds 600MB on a side. Only one side can be read at a time; to access the other half of the storage space, you flip the media over and reinsert it in the drive.

The internal 525GB drive has access to 600MB at once, while the 525GBX, which has two drives, can use 1.2MB at a time. Data transfer occurs at 6.5 million bits per second.

The drives come with WORM-TOS (Transparent Optical Software), which lets DOS treat the drives like regular magnetic disks.

List Price: ISi 525GB Optical Disk Subsystem (internal, 1.2 gigabytes), $5,988; ISi 525GB (external, 1.2 gigabytes), $6,188; ISi 525GBX (external, 2.4 gigabytes), $9,488. Information Storage Inc., 2768 Janitell Rd., Colorado Springs, CO 80906; (303) 579-0460, (719) 579-0460.

CIRCLE **439** ON READER SERVICE CARD



Information Storage's external 2.4-gigabyte optical WORM double drive, the ISi 525GBX, a full-height internal single drive is also offered.

Bus-Version Trackball Competes with Mice in Price and Convenience

MicroSpeed, of Fremont, Calif., has launched the first bus-version trackball, called PC-Trac. It differs from MicroSpeed's earlier trackball, FastTRAP, by using two rather than three axes in determining movement. It is also smaller and cheaper than the earlier product.

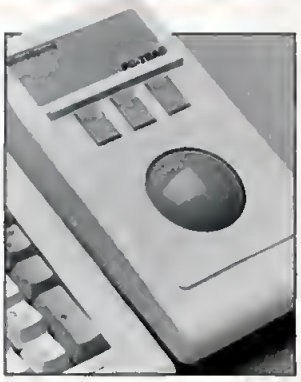
PC-Trac measures 4½ inches wide and is about the same height as most keyboards. It has three input buttons.

It is compatible with Microsoft Mouse programs, and MicroSpeed supplies a MAP (Multi-Access Pointer) driver that adjusts nonlinear ballistic gain in order to change tracking velocity to suit applications. The driver supports MDA, CGA, EGA, VGA, and Hercules graphics adapters.

MicroSpeed also includes software that lets you use the trackball with applications that don't support alternate input devices.

List Price: MicroSpeed PC-Trac, serial version, $119; bus version, $139. **Requires:** 256K RAM, serial port or expansion slot, one disk drive, DOS 2.0 or later. MicroSpeed Inc., 5307 Randall Pl., Fremont, CA 94568; (415) 490-1403.

CIRCLE **446** ON READER SERVICE CARD



The MicroSpeed PC-Trac features adjustable tracking sensitivity.

SunRiver Workstations

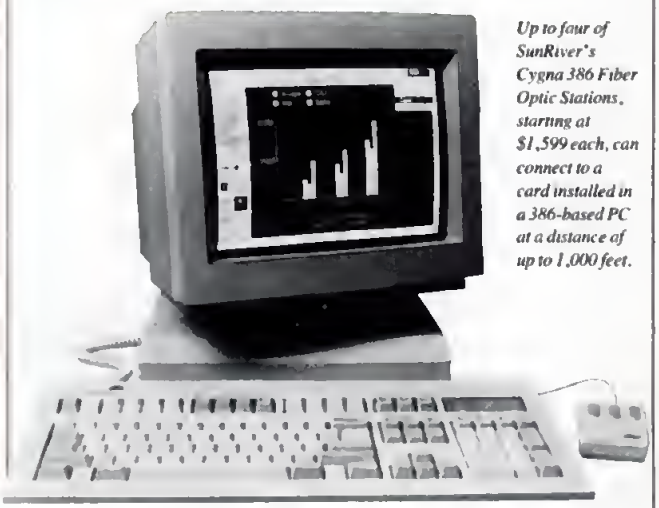
SunRiver Corp. is producing CygnaSystem, the first line of fiber-optic stations that relies on an Intel 80386-based, AT-bus host.

The Cygna 386 Fiber Optic Stations work with DOS-under-UNIX operating systems or with multiuser DOS operating systems.

The stations attach to an add-in board in the 386 machine, which can be up to 1,000 feet away. The data exchange rate is 32 megabits per second.

List Price: Cygna 386 Fiber Optic Station, CGA version, $1,599; EGA versions, $1,899 to $2,299; CygnAdapter, $799. SunRiver Corp., P.O. Box 9367, Jackson, MS 39206; (601) 957-0100.

CIRCLE **449** ON READER SERVICE CARD



Up to four of SunRiver's Cygna 386 Fiber Optic Stations, starting at $1,599 each, can connect to a card installed in a 386-based PC at a distance of up to 1,000 feet.

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PC MAGAZINE EDITOR'S CHOICE

UNlock MasterKey
EDITOR'S CHOICE
NOVEMBER 24, 1987

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PC MAGAZINE

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MultiLink Advanced (3.02, 3.03)
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Lotus 1-2-3 (1.A, 1A*, 2.0, 2.01)
Symphony (1.1, 1.2)
Lotus 1-2-3 Report Writer (1.0)
DoubleDOS (All)
Harvard Total Project Mgr (1.10)
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ThinkTank (2.0, 2.1)

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CHOICE OF THE CRITICS!

PERSONAL COMPUTING "UNlock has two particularly endearing characteristics. It works, and works simply. I was able to quickly produce unprotected copies ... These copies performed flawlessly, as did copies of these copies." *Christopher O'Malley*

BYTE "UNlock ... It's menu-driven and works fine on the program its supposed to work on: Lotus 1-2-3, dBASE III, Framework, Symphony, Paradox and several others." *Jerry Pournelle*

PC MAGAZINE "Because copy protection can interfere with the ability to back up a hard disk, business oriented users may prefer programs like TranSec's UNlock series" *Winn L. Rosch*

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UNlock is available for IBM PC, XT, AT and compatibles with at least 256K and DOS 2.1.

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$99 CD-ROM: Shareware Grab Bag on a Disk

PC HANDS ON

BY DONALD TRIVETTE

Shareware has come to the CD-ROM world. The $99 CD-ROM, from Alde Publishing, contains over 3,000 public domain programs drawn from bulletin boards and shareware authors across the country, is packaged in a plain brown wrapper, and (logically) sells for $99.

Alde's product takes a no-frills approach to what is normally a big-ticket technology. There's no documentation and only minimal instructions, but if you're a hacker, you can prospect for programs to your heart's content. And there are some nuggets to be found. The software is sorted by type into subdirectories, including communications, finance, graphics, games, DOS utilities, word processing, *dBASE* templates, *Lotus 1-2-3* utilities, and programming.

Two files in the root directory—DEAD.TXT (named for the Grateful Dead) and DIR.TXT—contain one-line descriptions of the programs. You search those files using your own word processor or text editor to locate potentially valuable software; you then copy the files to your hard disk using DOS commands. Most of the software is in an archival format—with program, data, and instructions squeezed into one DOS file—so you have to use an unarchive program to unsqueeze them. (Hint: there's one in the CHIC subdirectory.)

The software is split between freeware and shareware: about a third is free; with the other two-thirds you are asked to send a contribution to the author if you like the program.

Just when you think you've run out of programs, you discover the CHIC subdirectory with 2,000 programs from Loren Jones's Chicago Bulletin Board (born in Fargo, N.D., 1983). The description file isn't included in the CD-ROM's root-level directory because the programs arrived too late to be included. In fact, some of the subdirectories didn't make it. CHICAGO.DIR contains descriptions of programs that aren't on this CD, so if you see a gem in subdirectory DIR12, forget it. Nothing above DIR10 made the cut.

With all these complications, you must be wondering, "Why bother?" Where else can you get programs for three cents each? Besides, poor organization and inconsistencies are the spice of a hacker's life. PC



To choose from the 3,000 programs on The $99 CD-ROM, you scan one of the directory files using your word processor or text-editing program.

PC MAGAZINE FACT FILE

The $99 CD-ROM
Alde Publishing
Minneapolis, MN 55435
(612) 835-5240
List Price: $99
Requires: CD-ROM drive, Microsoft MS-DOS CD-ROM Extensions, DOS 2.1 or later.
In Short: A no-frills CD-ROM containing more than 3,000 public domain programs. There's no search software to help find programs, and the organization is poor, but at $99 it's a great buy for the hacker. Not copy protected.

CIRCLE 432 ON READER SERVICE CARD

@BASE Add-in Improves Database Capabilities Within Lotus 1-2-3

PC HANDS ON

BY STEPHANIE IZAREK

Add-in fever has swept software developers as Lotus encouraged third-party publishers to write utilities that enhance and expand *Lotus 1-2-3*'s basic functions. Some of the hottest new add-ins have been programs that give *1-2-3* better data-handling capabilities or help it link to database software.

From Personics Corp. comes *@BASE*, a *1-2-3* add-in designed to manipulate *1-2-3* data in *dBASE III*-compatible files with a minimum of fuss. The program stores files outside the worksheet, making file capacity virtually limitless.

Since *@BASE* is *dBASE III* compatible, you can directly read, manipulate, and perform calculations on your *dBASE III* files from within *1-2-3*.

@BASE can be invoked manually by using *1-2-3*'s add-in manager or run in auto-load mode so that it is always present when *1-2-3* is active.

Because it allows you to create a new database from scratch within *1-2-3*, a copy of *@BASE*, priced at $195, can save you the more expensive investment of *dBASE*. You can append, browse, and modify databases; search (via criteria conditions) for selected records; sort or replace your data; and pack records for deletion.

@BASE includes a Data Crosstab feature that lets you summarize information and produce reports on chosen fields in a file. *@BASE* also provides various @db functions similar to the @ functions in *1-2-3*. These create links between the spreadsheet and database, allowing for automatic updates and statistical analysis.

If you're constantly switching between *1-2-3* and *dBASE III*, or you want better database capabilities without shelling out for *dBASE III*, have a look at *@BASE*. PC

PC MAGAZINE FACT FILE

@BASE
Personics Corp.
2352 Main St., Bldg. 2
Concord, MA 01742
(617) 897-1575
List Price: $195
Requires: 72K RAM; *Lotus 1-2-3*, Release 2.0 or later; DOS 2.0 or later.
In Short: An easy way to create and maintain your *Lotus 1-2-3* data files in a *dBASE III* compatible form within *1-2-3*. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

Reflex: the database that maximizes your decision power

To get ahead in business, you must make decisions. And you must make them right . . . the first time. That's why you need the power of Reflex:® The Analyst. It's a



no-nonsense flat-file database that stores and organizes your information. Then works like a spreadsheet for sophisticated what-if analyses. Then shows you your information from every angle and perspective, uncovering all its hidden meanings. Then lets you move full speed ahead!

The view is up to you

Let Reflex break your data down. Turn it around. Show it off. And add it up. All with simple menus and commands that don't turn you inside out.

View your data one record at a time. Or all together in columns and rows. Create five different kinds of graphs. A numeric summary. Or a sophisticated report that makes everything fall into place. Even get a split screen that shows a form and graph at the same time. As you edit the form, your changes are instantly reflected in the graph!

Crosstabs show you the big picture

Reflex can give you a unique Crosstab view of your information—a powerful numeric summary divided into categories and displayed in a numeric summary table. Use it to pinpoint trends and relationships among the data and ask what-if questions. Your Crosstab shows Bob's average percent margin is higher than the other sales reps. Is he pushing too hard on price at the expense of volume? Quickly change the Crosstab for a second analysis, and Reflex will give you a whole new perspective.

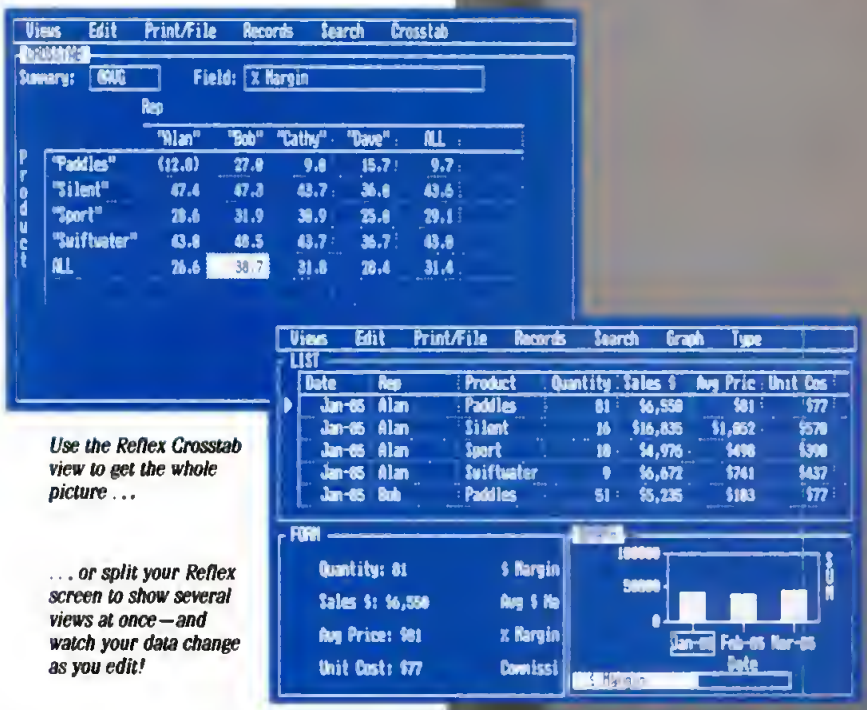
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BI 1233

Even generate reports for 1-2-3 and dBASE files

The Reflex Report view is a powerful report generator that can also accept files from popular applications like Lotus 1-2-3®, dBASE®, and and PFS: File. Use Reflex to generate everything from mailing labels to sophisticated custom reports—it's the only report generator you need!

The Workshop's templates make it easier

The Reflex Workshop, available separately, gives you 22 master templates for running almost any kind of business. The formats are all there; you just plug in the numbers.



Use the Reflex Crosstab view to get the whole picture . . .

. . . or split your Reflex screen to show several views at once—and watch your data change as you edit!

Maximize your decision power!

Give your decisions the power of Reflex. See your Borland dealer today.

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Bob Weeks, Chicago Computer Guide

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CIRCLE 377 ON READER SERVICE CARD

Arts & Letters Simplifies Graphics, Works with Windows, Exports Files

PC HANDS ON

BY EDWARD MENDELSON

Arts & Letters puts you in charge of a miniature design studio. Computer Support Corp.'s $395 graphics program for *Microsoft Windows* lets you manipulate 2,200 graphic symbols and 15 typefaces. You can arrange your words and images quickly and easily—and you can make them twist and shout.

You make the images twist by rotating, slanting, compressing, and stretching them. You make them shout by blowing up text to headline size. You can create drop shadows, thicken lines, crop out parts of an image, and improve the appearance of headlines by adjusting the spacing between characters.

With *Arts & Letters* you can design posters and flyers or create headlines and illustrations that can be exported to *PageMaker* or *Ventura Publisher* or saved as PostScript files. You can import graphics files and scanned images in any standard format. And although *Arts & Letters* won't generate graphs from numeric data, you can merge Lotus .PIC files and add symbols and captions. You can also import ASCII text in blocks of up to 5,000 characters.

Arts & Letters lets you edit one part of the screen while it repaints another. This means you don't have to wait for *Windows* to repaint the screen before you can start working again.

The graphic symbols that come with the program are stored in numeric format, so they can be expanded or reshaped without any loss of detail. You can superimpose or combine images, but you can't edit the supplied symbols or create your own. A $595 symbol editor, scheduled for release in the second quarter of this year, will add these functions. Meanwhile you can export symbols into any *Windows* paint program via the clipboard, edit them, and bring them back into *Arts & Letters*.



Arts & Letters provides 2,200 graphic symbols; 15 typefaces; and lots of ways to add color, resize images, and move them around. The rest is up to you.

You can buy extra collections of maps and technical symbols ($59 to $129). The well-designed fonts include IBM's full international character set. Eighteen optional fonts are available for $25 each.

Arts & Letters won't take the place of a $4,000 PostScript printer, but when you use it with a LaserJet and combine it with *PageMaker* or *Ventura*, it comes impressively close. PC

PC MAGAZINE FACT FILE

Arts & Letters
Computer Support Corp.
15926 Midway Rd.
Carrollton, TX 75244
(214) 661-8960
List Price: $395
Requires: 512K RAM, hard disk drive, *Microsoft Windows*, DOS 2.0 or later.
In Short: A fast and flexible toolbox for text and graphics. Can be used alone or to create headlines and graphics for desktop publishing programs. Not copy protected.

CIRCLE 435 ON READER SERVICE CARD

Instant Pages Provides Simple Page Layout with a Reasonable Price Tag

PC HANDS ON

BY JONATHAN MATZKIN

Carpenters live by a basic rule: use the right tool for the job. *Instant Pages*, from Electronic Arts, is the right tool for page layout tasks that stump your word processor but don't require desktop publishing heavyweights. The $49.95 package is an inexpensive way to prepare simple newsletters and common business forms.

Instant Pages operates in text processing or layout mode. In layout mode, you place and size boxes anywhere on the screen. You can then import ASCII text into the boxes or type text directly into them using the program's text processing mode. As you lay out the page, the program displays a WYSIWYG view of your work.

Text is automatically flowed into the boxes you define; *Instant Pages* interrupts text importation if the file's too big to fit. You can resize the box to accommodate the overflow or continue importing the text into another box. Once text has been placed, the boxes can be erased, leaving only columns of text. You can enliven your documents with simple graphics constructed from the extended ASCII character set.

There is also a helpful selection of predrawn layouts. This library includes several newsletter layouts and a multitude of business forms.

While *Instant Pages* does a good job on simple documents, it is quite limited. The selection of display type is minimal. Characters can be printed either double-high or double-wide, and that's about it.

Instant Pages is powerful enough, however, for its intended uses. And at $49.95, it proves that inexpensive software can be useful and easy. PC

PC MAGAZINE FACT FILE

Instant Pages
Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
(415) 571-7171
List Price: $49.95.
Requires: 256K RAM; MDA, CGA, EGA, or Hercules display adapter; Epson, IBM Proprinter, HP LaserJet with "Y" cartridge, HP LaserJet II, or compatible printer; DOS 2.0 or later.
In Short: A basic page layout package that is well suited for designing simple newsletters and business forms. Not copy protected.

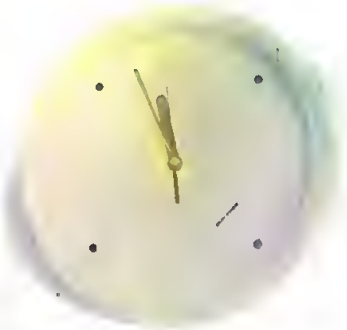
CIRCLE 436 ON READER SERVICE CARD

"Within a few days, SideKick *Plus* became even more indispensable than SideKick"

Dick Pountain, Personal Computer World

Here's what Personal Computer World had to say about SideKick® Plus:

"When the news of SideKick Plus arrived, I made up a shopping list of the improvements I would like to see ... Borland has provided all these things and much, much more."

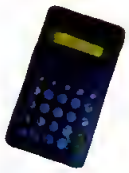


Intelligence and elegance of design

"I discovered that the same intelligence and elegance of design that initially attracted me are still there, and certain new features like the customizable menu system represent a real breakthrough in user interface design."

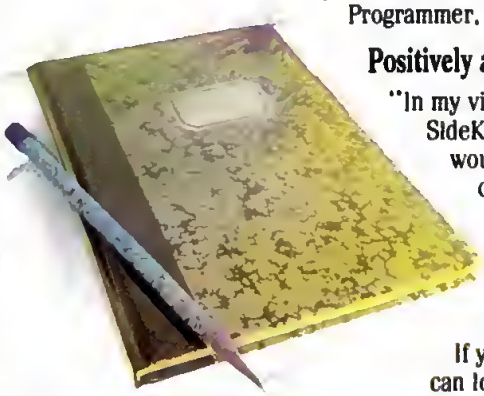
Sophisticated memory management

"Memory management in SideKick Plus is so sophisticated that it almost amounts to an alternative operating system ... The amount of memory tied up is tiny (less in fact than old SideKick!) ..."



The Phonebook: Fully-featured communications

"The Phonebook has come a long way ... For one thing, it has acquired a fully featured communications package which can work in the background; you can upload and download files while continuing to work on your PC ... The Script language is one of the best I have seen."



The Notepad: Power for serious writing

"The Notepad is as powerful as many word processors ... I would happily use it for serious writing." "Up to nine notepads can be opened simultaneously with SideKick Plus."

Outlook: The best outline processor

"Outlook is ... the best outline processor I've tried, comfortably beating ThinkTank, PC-Outline, and Ready! in elegance and ease of use."



3½" and 5¼" disks included.
Hard disk required.

For the IBM PS/2™ and the IBM® family of personal computers and all 100% compatibles

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BI 1227

The File Manager: Competing with the standalones

"The File Manager ... performs a similar function to standalone utilities like Xtree, Quick DOS, or the Norton Commander, and shares features with all of them."

The Time Planner: Hugely enhanced

"The Time Planner has advanced even further than the Phonebook ... it has been designed with networking in mind."

Plus a lot more

"The enhanced cut-and-paste functions are perhaps the most attractive feature of SideKick Plus ... [it] has a powerful, consistent ability to cut-and-paste from any application to any other."
"The calculator is no longer one, but four calculators: you can switch the type to Business, Scientific, Programmer, or Formula."

Positively addicting!

"In my view, the individual applications in SideKick Plus are of such a standard that I would be hard put to better them with a collection of standalone applications ... I remain an addict."

Excerpts from Dick Pountain's review of SideKick Plus in Personal Computer World, March 1988.

If you have the Intel® Above™Board you can load the SideKick Plus desk accessories into expanded or extended memory and leave most of your conventional memory to run your other applications.

Ask your dealer about Borland's special offer for SideKick owners.

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CIRCLE 137 ON READER SERVICE CARD

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Prices quoted are US Domestic suggested retail prices

CIRCLE 173 ON READER SERVICE CARD

PC UPDATE

edited by Peggy Gavan

Microsoft Languages

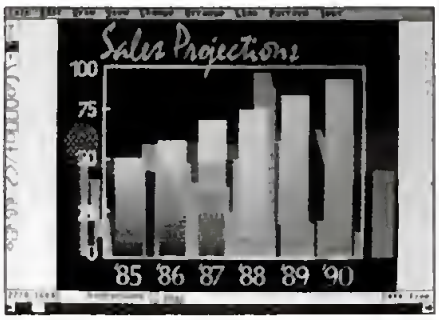
Microsoft Corp. has upgraded its family of languages to allow the development of both MS-DOS real-mode and OS/2 protected-mode applications. The new versions—**C Optimizing Compiler**, Version 5.1, **Macro Assembler (MASM)**, Version 5.1, **BASIC Compiler**, Version 6.0, **FORTRAN Optimizing Compiler**, Version 4.1, and **Pascal Compiler**, Version 4.0—can run in and generate code on both operating systems. All five languages feature data browsing, the debugging of multiple threads and processes, and Microsoft's enhanced CodeView Debugger and Editor. For pricing and upgrade information, contact Microsoft, Redmond, Wash.; (206) 882-8080.

PicturePower

PictureWare is bundling the latest version of its *PicturePower* picture database software—Version 1.7—with a free color image capture board for PS/2 computers. The introductory offer, priced at $995, will end July 31, 1988. *PicturePower*, Version 1.7, takes advantage of the PS/2's graphics and monitor, using the 256 simultaneous colors available from the VGA's palette. The image capture board, made by Jovian Logic Corp., regularly sells for $750. The software upgrade will be available free of charge to registered owners of *PicturePower*, Version 1.6. PictureWare Inc., Bala Cynwyd, Pa.; (215) 667-0880.

Graph Plus

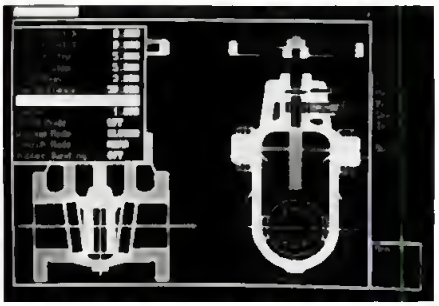
Micrografx is upgrading its *Windows Graph* program to include *Windows* 2.0 support, an integrated drawing editor, color gradients for charts and symbols, and other new features. The new release, called *Graph Plus*, provides complete desktop presentation capabilities through a new device driver in combination with General Parametrics Corp.'s **VideoShow Presentation System**. The VideoShow driver is included free with *Graph Plus*, *Designer*, and *Windows Graph*. *Graph Plus* retails for $395 and is available free to registered users of *Windows Graph*. Micrografx Inc., Richardson, Tex.; (800) 272-3729, (214) 234-1769.



Micrografx's Graph Plus, *an enhanced version of* Windows Graph, *offers desktop presentation capabilities.*

TurboCAD, Version 1.5

TurboCAD, Version 1.5, offers macros, improved symbol handling, and a retail price of $99.95, reduced from $395. In addition, Milan Systems America is offering the new version of



Milan Systems has slashed the price of TurboCAD *and added several enhancements with the release of Version 1.5.*

TurboCAD bundled with KYE Corp.'s **Genius Mouse** for $179.95. The mouse retails separately for $99.95. Milan Systems, Atlanta, Ga.; (404) 642-4131.

Series VII Database Accounting Library

SBT Corp.'s *Series VII Database Accounting Library*, an upgraded version of the *Series Six* products, utilizes the capabilities of *dBASE IV*. *Series VII* has transaction rollback, pull-down menus, and the *dBASE IV* source code. Registered users who purchased the *Series Six* modules after February 1, 1988, can upgrade for a 10 percent processing fee per module. Other registered users can upgrade for the difference in retail price, from $100 to $300. SBT Corp., Sausalito, Calif.; (415) 331-9900.

Tornado, Version 1.8

Micro Logic Corp.'s *Tornado* random information processor now offers a learning mode option, in addition to a new menu layout, increased ease in creating multiple stacks of windows, and an enhanced manual. Version 1.80, priced at $99.95 ($149.95 for the library version), is available to registered users of earlier versions for $20 to $50, depending on date of purchase. Micro Logic, Hackensack, N.J.; (800) 342-5930, (201) 342-6518.

IN BRIEF

Dell Computer Corp. has dropped the base price of its **System 300** 80386 computer from $4,299 to $3,299. Dell Computer, Austin, Tex.; (512) 338-4400 . . . Goldata Computer Services' *D.A.V.E.*, a $149.95 database add-in for *Lotus 1-2-3*, is now available in a version compatible with *Lotus Symphony*. Goldata, Bryn Mawr, Pa.; (215) 525-1036 . . . Boca Research is shipping upgraded software (Version 1.3) with its **BocaRAM/AT** board that contains a driver for LIM EMS 4.0. Boca Research, Boca Raton, Fla.; (305) 997-6227.



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DataEase Developer provides everything needed to build complete professional applications with evaluation copies, self-running demonstration disks, encrypted applications and serialized versions to protect applications from unauthorized use.

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DataEase Developer. Because everybody needs documentation but nobody wants to do it.

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(in Connecticut, 374-8000) for more about DataEase Developer.

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Tools for the applications generation.

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CIRCLE 391 ON READER SERVICE CARD

COMMUNIQUÉS

edited by Bill Howard

Amazing Facts

"Analysts said Compaq's sales last year benefited . . . [from] the decision by IBM in midyear to quit producing models based on the older 80286 microprocessor . . . .Compaq so far has not strayed from the design used in IBM's PC, XT, and AT machines, which were based on the 80286 microprocessor."

—The New York Times, *February 2, 1988*

You Must Be 18 to Use This Camera

"Video. Another hot area is charged-couple devices, a video imaging chip used in nearly all video camcorders."

—San Francisco Chronicle, *February 18, 1988*

Lucid Thinking I

"Finally, the company announced AIX PS/2 ($595 license fee), an operating system that will enable PS/2 Model 80s to support up to 16 users running AT&T's Unix operating system on the IBM RT line of Personal Computers."

—Personal Computing, *January 1988*

Lucid Thinking II

"'Every time somebody buys a new PC, they buy a whole bunch of software,' says Alexander Paris. 'People also keep upgrading their software, and with new computers having more capacity, there's a need for bigger programs.'"

—Personal Investor, *January 1988*

Classified Intelligence

AT&T 6300 with 10 meg HD, high reds color monitor. Includes software. $2500. xxx-xxxx

—Omaha *(Neb.)* World Herald, *January 29, 1988*

Compaw Portable: 512 ram, 1 floppy drive, 20 mpg hardrive, 5 mag software, Okidata, dot matrix printer, with box of paper. All excellent, $1550. xxx-xxxx.

—Brockport *(N.Y.)* Shopping Bag, *February 2, 1988*

We rent & lease micros . . . Compaq 386; AT&T 6300 Laptops; Apple Macintosh . . . National Microrentals xxx-xxx-xxxx

—PC Week, *January 19, 1988*

IBM XT with 10 megabite hard drive, color monitor, 5.25 floppy diskette, 3.50 floppy, Ferrari key board, Epson graphic printer. $1600 OBO. xxx-xxxx

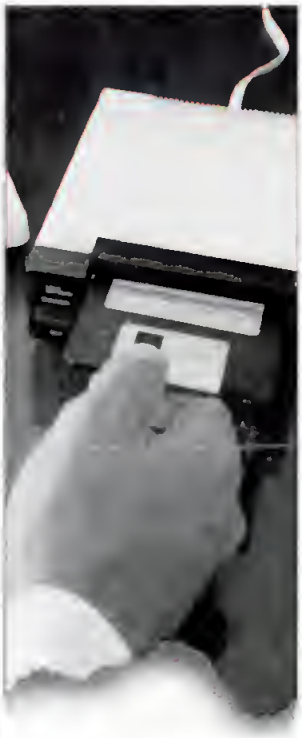
—Fort Lauderdale *(Fla.)* Sun-Sentinel, *December 18, 1987*

Compaq Portable Plus, 10 Meg. hard disk, Lotus-PFS Wright, $1199.

—San Antonio *(Tex.)* Express-News, *January 26, 1988*

SALES
& SALES
MANAGEMENT
COLLEGE GRADS
Join us at our:
OPEN MOUSE
WEDNESDAY, JAN
13
6PM SHARP
RADIO SHACK
COMPUTER CENTER
385 5th Ave, NY
Call Ronnie for Reservations:
201-238-7121
Tandy will get
your career
Up & Running..

Ag school business majors especially welcome
(The New York Times, *January 10, 1988.*)



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Winners this issue: Steven Ganz (open mouse), Michael Shrout (Tandy disk drive), Andres Ramirez (AIX PS/2), Paul Albrecht (bigger programs), Andrew Hurdidge (Compaq's sales), Dave Bland (charged-couple devices), Patricia Phelps (Ferrari key board), Kent Schneider (AT&T 6300 laptops), Eric Gates (Lotus-PFS Wright), Mary Jo Orzech (Compaw 20 mpg drive), Paul Drazen (high reds monitor).

Illustration: H.L. Schwadron

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CIRCLE 365 ON READER SERVICE CARD

■ BILL MACHRONE

ON-LINE SYSTEMS: THE FAILURE AND THE DREAM



Computers, terminals, and modems are everywhere. The mainframe and datacomm networks have never been more powerful. Still, the public information systems languish.

If you'll pardon the pun, on-line information services are terminally ill. No, they're not in danger of going out of business. They're not staring down the gun of a replacement technology. Their only problem is that they started business too early—before personal computers were invented, much less endemic.

The information services' biggest enemies are themselves. They still scroll information by your tortured eyes at 1,200 bits per second, with nary a thought to friendliness or ease of use. Computer users, coddled as we are by the snazzy user interfaces on our PCs, have come to expect more.

Videotext certainly hasn't been a challenge, much less an expansion market, for a couple of reasons. The first obstacle is the ubiquitous television set. Prognosticators and product planners have long been tempted to use it as a terminal, but it's a lousy choice. It's too low in resolution for all but the crudest graphics, and it's difficult to interface with a computer. The other big problem is that the television is fed by the already-crowded airwaves or by receive-only cable systems. Neither method is a solution for the quick interactivity that is required by today's consumer of information.

The personal computer is a far better choice of terminal. In character mode, the information density on the screen is several times higher than that of television, especially in text applications. Also, no one's watching reruns of "The Brady Bunch" just when you need to look up something important. Of course, the PC has an incredible amount of local intelligence, a fact so far resolutely ignored by the information services.

Instead, they're mired in terminal-think. They've designed to the lowest common denominator—the dumb terminal. Most information services can do little more than clear the screen. The sad part is that they probably consider it a breakthrough after having been so attuned to the old 110-bps ASR33 Teletype. In fact, virtually all information systems treat the user's terminal as though it were a "glass Teletype." The result is fatigue, boredom, and confusion as information scrolls by your little 25-line window on the world, perhaps never to be seen again.

INFORMATIONUS REX For a while, information services were as bewildered by PCs as the dinosaurs were by the first mammals. The profusion of unstandardized, scurrying little beasts only confused the big guys—when they could stop laughing. Even when natural selection began to weed out the more poorly adapted PCs, they saw no point in trying to standardize on an interface to them. It was much easier to just let the little beasts emulate dumb terminals.

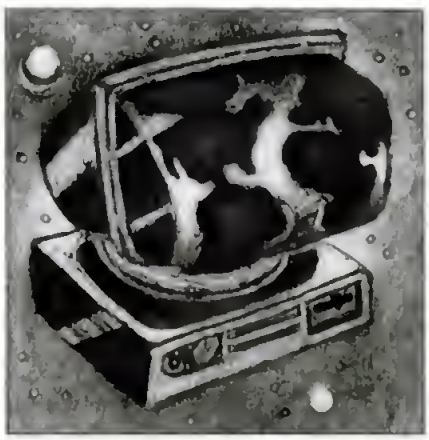


Illustration: Michael Donato

Now two standards dominate all the others: IBM PC and Macintosh. It's time for the information services to take a long, hard look at what's on the other end of the wire. Now that there are two major interfaces (and maybe three minor ones), information services can begin to work with them.

The first step is to write communications software for the PC that is intimately familiar with the design and operation of the information service it is calling. You can make the marriage substantially better by giving both the PC and the on-line information service a communications protocol that the user never sees but benefits from enormously.

CONQUER THE WORLD Once the information service and the PC begin to work together, wonderful things begin to happen. The world was once a collection of lonely, isolated places. Navigation changed that and opened global commerce. All it took was a few simple tools: a compass, a sextant, and a reasonably accurate timebase. Similarly, PCs and information services need a few simple tools. For instance, the software on the PC can ask the mainframe, in the background, "Where can I go from here?" Then it builds a menu of choices for you. The PC

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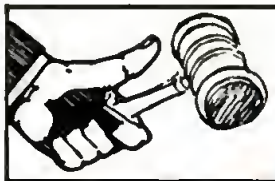
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CIRCLE 293 ON READER SERVICE CARD

■ **BILL MACHRONE**

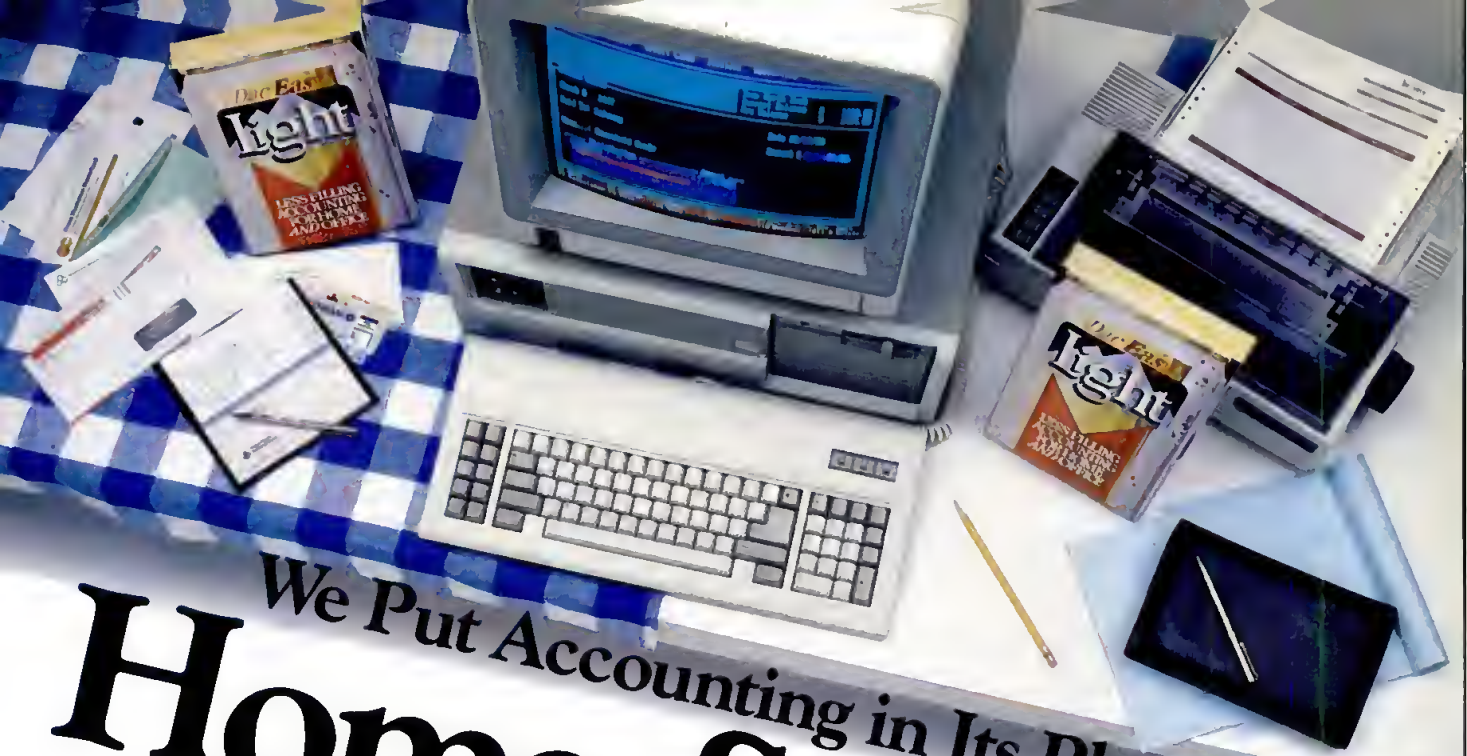
also needs to remember where it's been so it can return there. If, for example, your PC has already displayed a menu screen, it should save it locally and pop it onto the screen when required. You can then navigate around an information system far faster and never get lost.

It's time to take the intimidation factor out of on-line systems. The people who use them effectively today are incredibly facile at remembering where they've been, what the options are, and where they can go next. That's a job for software. I don't want to put these experts out of business, but the information services can't grow unless they become more accessible to the average user.

IBM, for one, obviously agrees. In partnership with Sears, it will soon offer Trintex, a videotext service that is based on PCs, not television sets. They haven't been very forthcoming with information, but from what I've heard, it sounds something like an on-line cross between *USA Today* and *Business Week*: lots of short, snappy articles, complete with graphics where appropriate. Trintex's great hope is that everyone will sign on once a day, for 5 or 10 minutes, to follow something that they consider important. Of course, it'll do all the news filtering and story selection that a good news database should. But it'll require a full-boat PC or PS/2 to run: 640K, and EGA, MCGA, or VGA graphics. If it catches on big, look to IBM's PS/2 Model 25 or its successor as the ideal Trintex terminal.

Meanwhile, our existing PCs are already ideal terminals for on-line systems. But even the best communications software can't do all the work. You need both ends of the wire to work together, as peers. Most important, however, is that the information systems add the tools necessary to convert the view of the data from that of a flat Earth to a true, three-dimensional view. Then personal computers can get on with the business that's always been at hand: making information more comprehensible and easier to process.

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CIRCLE 152 ON READER SERVICE CARD

■ JOHN C. DVORAK

WHO TOOK THE "PERSONAL" OUT OF THE PC?



Recent trends would not have surprised George Orwell. Control over the PC is now moving further away from the people who made it so popular.

Somewhere, somehow, it happened. The personal computing revolution turned away from its roots. Somebody stole the "personal" from personal computing.

Personal computing started in 1975–1976 when individual users found that they could afford to have a computer dedicated to serving one person. Articles were written about how all this would revolutionize our society. The personal computer was seen as the last great tool—extending the brain much like machines extended our strength and television extended our vision.

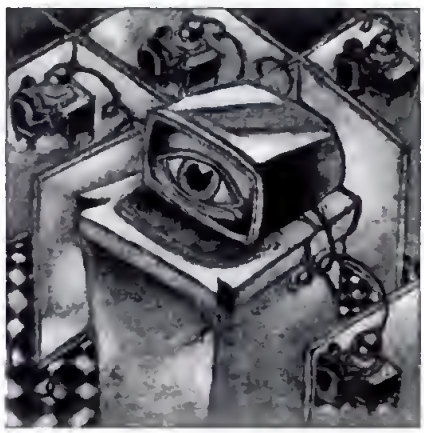
The biggest detractors of the personal computer scene were the paid guardians of technology—the keepers of minicomputers and mainframes. To them these diminutive little micros were no more than toys—a joke—useless.

Undaunted, personal computer users began to show how these cheap machines could be used for business. This was done to gall the big boys, who denied that the smallish machines were good for anything, despite the fact they were more powerful than the so-called business computers of the late 1950s and early 1960s. Those old mainframe clunkers with core memory relying on punch cards were no match for a new micro.

When the micro began to sneak into the corporation and when the spreadsheet was developed, the complainers finally took notice. Finally, 6 long years later, IBM recognized the personal computer by announcing the PC. PC meant Personal Computer.

CONTROL CRACKDOWN It's no coincidence that IBM doesn't sell a PC anymore. The "personal" is gone. It was getting out of control. Once the machines began to creep into the office they had to be managed by the bosses. It's impossible for American business to deal with individuality on any significant scale. One or two oddballs with a computer was okay, but hundreds of people doing who-knows-what with the little machines was more than any manager could handle.

"They play games on the damn things!" "How do I know he's doing any real work on that thing?" "What does *she* need a computer on *her* desk for?" Moans and groans came from the sacrosanct corridors of corporate America. The MIS people, at first, said it was no big deal, not noticing that users would no longer tolerate having "just a terminal" hooked to a mainframe. They would accept a PC hooked to a mainframe as long it was a PC first and a terminal only when necessary.



Soon it was discovered that there was no way to control employees if you didn't have access to their machines. These were still personal computers, and all the fears about game-playing were still there. Something had to be done to lobotomize the whole notion of personal computing. Drastic action was needed.

What to do? What to do? A new formula for control was needed. A formula more rigid and more villainous than the central mainframe or the multiuser mini. The answer was the sinister Big Brother of personal computing: the network.

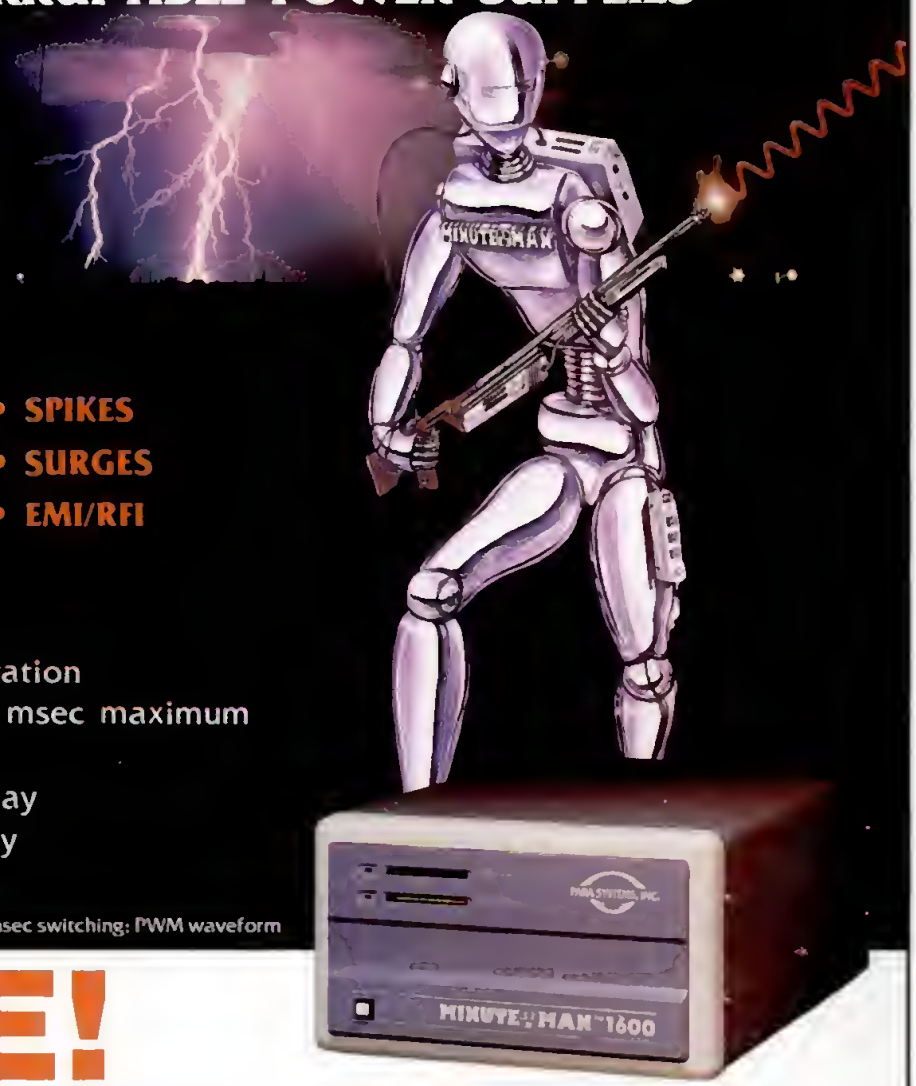
For years, attempts were made to introduce networks as inexpensive ways to share an expensive printer or a hard disk. Some networks are still sold for this reason. But it is not their real purpose. The purpose is control. (I always felt that a network was good for one thing: to poll an installation to see if any machines were stolen.) Now, hooked to large so-called "servers," the network system is the new mainframe with less power and allowing even less freedom than before. File security, provisional gateways, and constant surveillance make the environment more restrictive than ever.

An amusing videotape from Microsoft, extolling *Excel for the PC*, unknowingly expresses this new repression by showing a bunch of yuppies skulking around the office like criminals so they can use the new "unapproved" spreadsheet. This is the environment of today's personal computing. It looks like 1984 is coming a little late, but coming nonetheless.

Illustration: Michael Donato

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CIRCLE 381 ON READER SERVICE CARD

■ JOHN C. DVORAK

INSIDE TRACK

Is IBM betting the company on the 386? Or is it putting its money on the 2-inch hard disk?

IBM rumors are rapidly running rampant. Since the recent company reorganization, employees are worried about losing their jobs. While the reorganization was sold to the public as a "streamlining," insiders say most of it was punishment to those IBMers who failed to perform well over the past couple of years. The minicomputer people may have been hit hardest. Anyone who invented, promoted, or marketed one of the **IBM ding-a-ling products,** such as the **4-inch floppy** or 128K of a piggyback AT RAM a few years back, is now either gone or in the statistics department for penance.

The IBM ding-a-ling products won't stop there. The latest is the **IBM 2-inch hard disk** that IBMers insist will be introduced before year's end. When you ask them, "Do you mean 3½-inch disk or do you mean 2½-inch floppy?"—referring to the little Maxell disk used in the new Japanese electronic cameras—they say, "No! 2-inch." This should go over about as well as the **wacky** 6½-inch floppy invented by IBM just before Shugart introduced the 5¼-inch diskette that became the worldwide standard. The 6½-incher, designed to be more reliable and to replace the 8-inch floppy, had read/write heads that came in on both sides of the disk from opposite corners. This corner mounting supposedly resulted in more stability or some such nonsense. The new motto at IBM should be, "Remember the Chiclet keyboard!"

This is an appropriate play on words since the Alamo isn't that far from **IBM Austin,** where a number of secretive projects may be threatened because of the reorganization. This includes a **whopper** inexpensive workstation. The whereabouts are now a mystery.

There is also some **mystery shrouding** the purpose of the **huge skyscraper** that IBM built in Atlanta. Some speculate that Atlanta is scheduled to become the **new corporate headquarters** some day, replacing chilly Armonk. Atlanta has better weather, better living conditions, better cost of living. There is also room to expand, and Georgia Tech is nearby to provide **droves of grunt engineers.** Atlanta also is one of the three or four high-tech centers in the country. The drawback is that once you leave the city limits, you're in the middle of the Georgia woods. There is no Vermont, New Hampshire, Boston, or New York City nearby—just little towns peopled by all sorts of characters, few of whom cotton up to them IBM yankees. "Billy Joe, lookee heah at the slicker. Let's see if he likes to dance!" That's when they **throw rib bones** at his Ferragamo loafers.

Some also say that the Boca facility will have its **honchos pulled out** and back to HQ (or Atlanta) for one or both of two reasons: (a) they're becoming too autonomous or (b) they failed to make enough marketing hay with the PS/2.

That doesn't mean things are **slowing** down. With announcements from IBM starting in April and continuing to the end of the year, we've already heard some fascinating speculation. Supposedly the next series of announcements will show us that the new **minimum PS/2** system will come with **3 megs** of memory as a standard with at least a **40-meg hard drive.** This is done to accommodate OS/2 and, because of chip prices, the timing couldn't be worse.

Also rumored is **another new "standard" keyboard!** This baby has **16 function keys** and some new "hot" key designed to do OS/2-specific chores. The way they're getting bigger, users are going to need a forklift truck just to move the keyboard.

Recently, at a techie event held by IBM in Florida, there was some indication that IBM will make **two bold moves** within the next 12 or 18 months. First: All the PS/2 machines will have a microchannel bus, including the low-end machines. Second: All the PS/2 machines will be fitted with an **80386.** IBM's concern over protecting its profitable but technologically backward minicomputer business is a policy that may be kaput. So here comes some low-end power for everyone. This would be a smart move for Big Blue.

It had better do something fast, because if nothing else is happening in this business, raw processing power is coming on strong. Motorola's recent announcement of its 88000 microprocessor (rated by some as high as **17 mips!**—compare with the 2-mip 80386) has everyone talking. If the Motorola chip can actually be manufactured inexpensively—which seems to be the rule, not the exception, in the semiconductor business—then we can expect other micro makers to follow suit and the next round of machines will be **killers.** Gee, I can't even imagine how fast *WordStar* will boot at 17 mips!

Genuinely Interesting Software Dept.: For $5.95 you can get a copy of ***PC-Hypertext*** from MaxThink, 44 Rincon Rd., Kensington, CA 94707. Neil Larsen, guru of the company, prefers that people **download it for free** from data library DL-0 on CompuServe's IBM-SW SIG. It's a hot little hypertext system from a small company that is making waves in the commercial expert system–building business. Its products include a nifty outliner and an expert system builder. $89 each. *MaxThink*, the superb outliner, is the outliner I personally use. Call (415) 428-0104 for more information.

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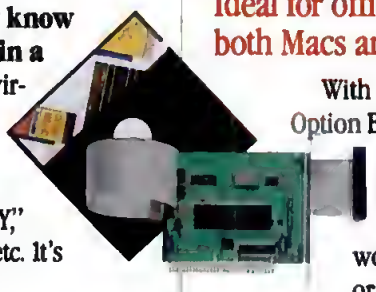
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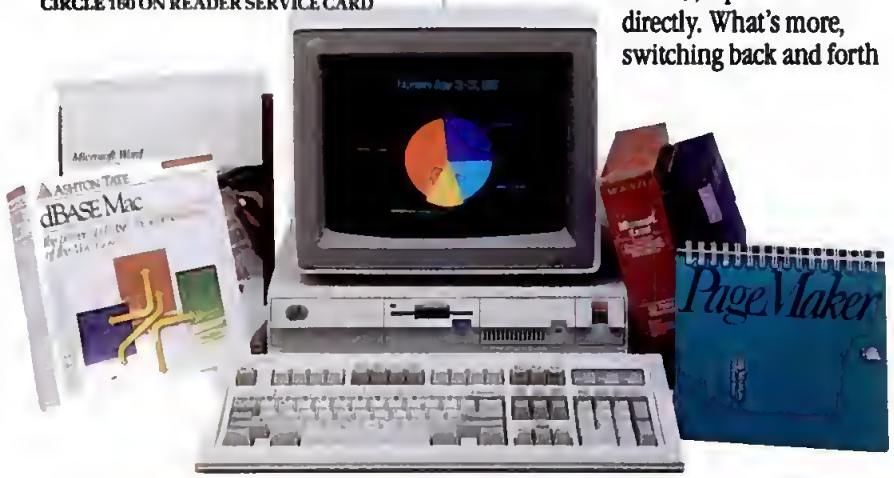


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CIRCLE 373 ON READER SERVICE CARD

■ JIM SEYMOUR

A SPREADSHEET TAXONOMY, PART 3



Seymour wraps up the series with his assessment of Lotus's eagerly awaited 1-2-3, Release 3, and 1-2-3/G—and with sound advice on which new spreadsheet program is right for you.

We've examined, over the past two columns, some of the issues in considering a move to one of the hot new entries in the Spreadsheet Wars: *Microsoft Excel*, *Lucid 3D*, *Surpass*, and *Quattro*. And I offered my analysis of how the market will tag each of them.

But assessing who's going to move to which new program, and why, without acknowledging the vaporous cloud cast over the spreadsheet software market by Lotus's announced plans to deliver a new, character-based *1-2-3*, Release 3, this spring or summer, and its graphical interface *1-2-3/G* (running under OS/2 1.1's Presentation Manager) later this year—would be ignoring reality. Because a lot of current spreadsheet users are wondering whether they should make a change now at all or wait to see what Lotus hath wrought in those new releases.

PC Magazine executive editor Bill Howard often remarks about how little *1-2-3* has really changed over 5 years, and he's right: through five releases, it remains remarkably close to Jon Sachs and Mitch Kapor's original creation.

One way to read that is that Sachs and Kapor did a great job. Another is that the Lotus people knew a good thing when they saw it and didn't want to mess it up. A lot of *1-2-3* users, though, feel it's less either of those answers than simply that Lotus was milking revenues from its cash cow long after a decent respect for its customers demanded a product with some fresh cream.

Preferring evolutionary fixes is understandable in a $350 million company, if not exactly congruent with the style that took Lotus from zero to more than a third of a billion dollars in sales in 5 years.

NEW AND IMPROVED? This year's *1-2-3*, Release 3, and *1-2-3/G* are Lotus's opportunities to hold on to that rich franchise and also to regain technological leadership.

I've seen *1-2-3*, Release 3, and I like it. Lotus is being cautious about warning potential buyers that this isn't a "next-generation" spreadsheet program but an evolutionary version of *1-2-3*. With good cause.

The new *1-2-3* adds important features, from multiple-sheet linking to intelligent recalculation to more graph types (and an end to having to leave the program and load *PrintGraph* to get those graphics onto paper). But there is this nagging feeling that these features should have been there long ago. Since *1-2-3*, Release 3, is a familiar extension of the current product, it guarantees a shorter learning curve for those moving up from *1-2-3*, Release 2.01. But can't it be a little *too* familiar—which is to say not enough improved?



Illustration, Michael Donato

As much as I like Release 3's features and look forward to working with the release-level product—and as likely as I think it is that Lotus will upgrade a large percentage of its installed base to Release 3 in short order—I don't think this is enough.

I recall too clearly the howls from those who eagerly upgraded from *1-2-3*, Release 1A, to Release 2.0—only to find a product they quickly realized should have been called Release 1.1. Will *1-2-3*, Release 3.0, feel like Release 2.1?

The second new Lotus entry, *1-2-3/G*, seems to me the big test for Lotus—and the big hope for spreadsheet users. When *1-2-3/G* is delivered this fall, *Excel* will have been out for a year. David Gilmour's *1-2-3/G* development group at Lotus will have had a year to peek under the hood of *Excel* and run focus groups to see what buyers do and don't like about it. Lotus has to deliver a product not only demonstrably better than *1-2-3*, Release 3, but also better than *Excel*.

Ah, but to make the job even tougher, Microsoft's *Excel* team will also have had a year in which to tweak and refine and extend *Excel*, to run their own focus groups, visit user groups, and hold corporate kaffeeklatsches to see what people want more and less of.

And we can surely expect a new release of *Excel*, informed by that year's experi-

■ JIM SEYMOUR

ence, about the time Lotus rolls out *1-2-3/G*.

So the challenge for Lotus is three-pronged: with *1-2-3/G*, they not only have to be better than their own new Release 3, and better than the fall '87 release of *Excel*, but also better than the fall '88 release of *Excel*. And *that's* going to be a test of corporate character and depth, even more than it will be a battle between East and West Coast programming and product-development styles.

So what to do?

I'd look at all four programs. If I didn't find things in *Surpass* and *Excel* that I had long wanted in *1-2-3*, *I'd do nothing*. Remember: *1-2-3*, Release 2.01, isn't exactly chopped liver.

But if, as a power spreadsheet user, I were drawn to the "more *1-2-3* than *1-2-3*" feeling of *Surpass*, I'd jump on it; it's an exceptional program. Or if, in *Excel*, I saw not just features I wanted but also a more flexible and natural style of working, I'd make that move.

■ *Lotus 1-2-3* has changed little over 5 years; it remains remarkably close to Jon Sachs and Mitch Kapor's original creation.

Certainly some will find in *Excel* a forbiddingly different world. They shouldn't think for a minute that they have to embrace *Excel*'s new ways and metaphors to stay in the power-spreadsheet league. Again: *1-2-3*, Release 2.01, is hardly minor-league stuff.

If I were looking for a spreadsheet for people who use one only occasionally—say, for secretaries who need a much better tool than a word processing program's clumsy "columnar math" features to do numeric tables and get the calculations right, or for salespeople who want to track their expenses on worksheets on laptops—I'd pounce on *Lucid 3D*.

And *Quattro*? I'd turn to it if price were the imperative and I needed to put spreadsheet software on an awful lot of desks for not much money. But I'd think twice before embracing it as a replacement for *1-2-3*, and I wouldn't fool myself that it (or *Surpass*, or *Lucid 3D*) represents a leap to the next generation of spreadsheet software.

That's clearly *Excel*'s turf. At least until fall, when we see what Lotus has been up to with *1-2-3/G*.

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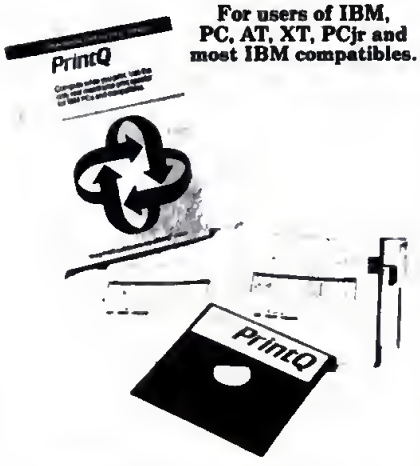
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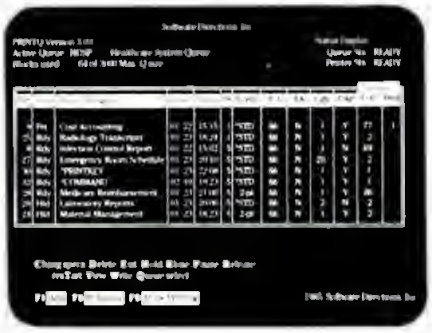
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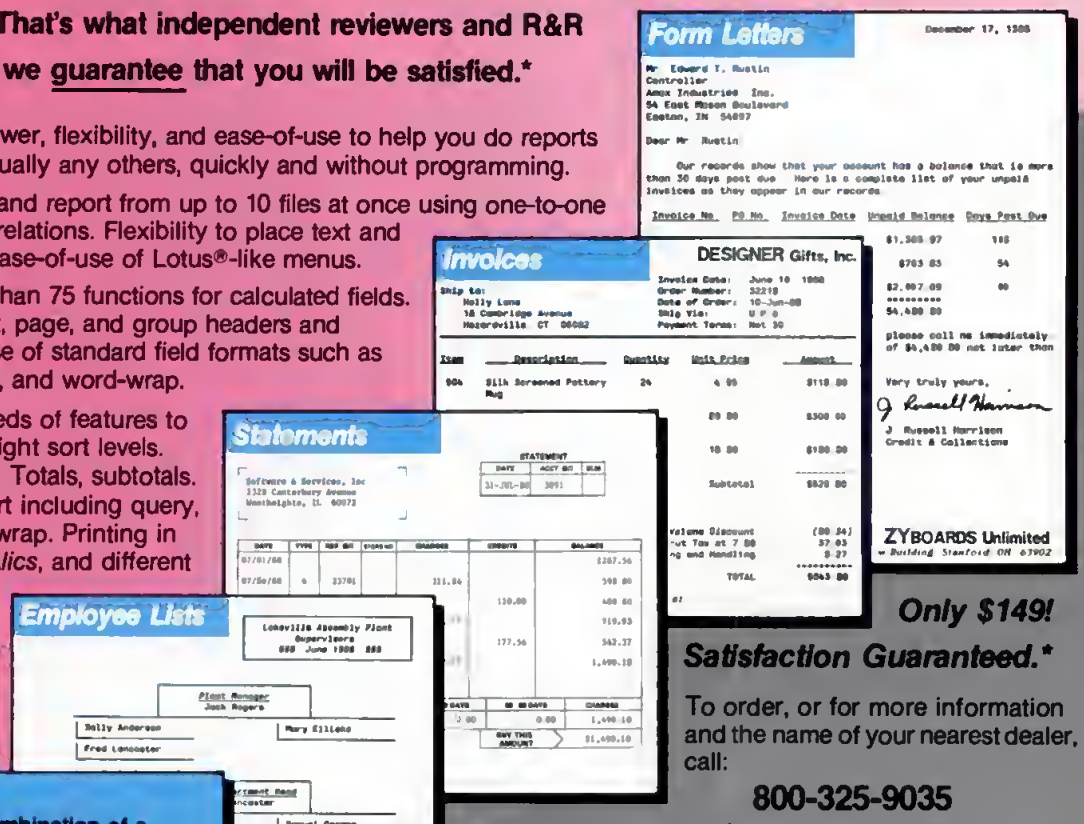
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■ STEPHEN MANES

THE GRIPES OF SPRING



In spring a columnist's fancy lightly turns to thoughts of power transformers, extended memory specifications, TSRs, CD-ROMs, and baseball.

As the monitor casts its roseate glow upon the budding crocuses and the CPU's fan wafts attar of magnolia across the room—oh, but why pretend? As I write, the street slush is freezing hard, the radio is emitting the words "wind chill" and negative numbers, the radiator is emitting nothing, and I'm warming my digits over the expanded memory card. Still, all too soon will come the rites of spring: baseball and housecleaning. In that spirit, I hereby pitch out the discerning opinions, pithy remarks, and clever observations I've fermented in the root cellar these long, chill brumal days.

ELECTRIC SHOCKS Every third peripheral that comes through the door nowadays seems to be attached to one of those transformer bricks that make the floor look like Roach Motel Row. That I can live with. What's maddening is the trend toward putting the power plug on the brick itself.

Two-prong models are bad enough, but at least they let you flip the brick to avoid its interfering with your other outlets. Eternal damnation, however, goes to those who put a three-prong plug on the transformer, thereby ensuring that it will screw things up.

The most recent offender—Okidata's otherwise fine 2,400-bit-per-second modem, which eliminated from my FM radio the peculiar emanations of my ancient Hayes 1200—managed to align the brick to cover either the switch or two outlets of my power strip. A three-prong extension cord was the only solution.

Listen up, vendors: If you must put the juice outside the product, do it the way Toshiba's T1100 Plus laptop does. For maximum flexibility, its brick is right in the middle of two longish cords, one to the computer and one to the wall socket. Unless you or the outlet is on the ceiling, you can invariably set the brick out of sight on the floor—where it belongs.

CREDIT WHERE DUE The folks at AST seem justly miffed that they're not getting proper credit for the yeoman work they did in pioneering and keeping alive the hardware/software idea that became the LIM 4.0 expanded memory spec. As far as I can tell, LIM 4.0 is little more than AST's long-suffering EEMS spec with a couple of extra goodies tossed in—and, just for perversity, a couple of needless incompatibilities as well.

From the start, AST took a lot of grief for EEMS, including much misinformation and disinformation from competitors. The low point came when Quadram, AST's erstwhile partner-in-spec, claimed its own board had both EMS and EEMS compatibility—low, because EEMS itself is a superset of EMS and fully compatible with it. Shouting in the darkness, AST virtually single-handedly kept its concept alive.



What's particularly amusing is that even the oldest AST EMS boards implement multiple page registers, an important aspect of the EMS 4.0 spec, in hardware—just as newer boards from competitors, notably Intel, have finally begun to. Intel's older-model Above Boards and most other vintage EMS boards don't support the full 4.0 spec in hardware and won't—ever. So far this is crucial mainly if you want to run *DESQview*, but it may become more useful in the future, particularly if OS/2's quirks keep it from gaining quick acceptance. Perhaps LIM 4.0 should more properly be known as LIMA, in honor of the beans that kept it simmering.

UP FROM 640! And are you as tired as I am of TSR programs that insist on taking "just 80K" of your south 640? Every time I mention expanded memory support to a software developer, the reply is the same: "Yeah, that's definitely in the spec for Release 2." The only developers who've made good on the promise are the folks at General Information: Release 2 of their dandy *Hotline* program uses a grand total of something like 3K of main memory if it finds 80K or so of free expanded memory—and does so automatically.

Illustration: Michael Donato

■ STEPHEN MANES

It's shameful that so few TSR programs bother to take advantage of EMS. Besides *Hotline*, the honor roll includes *Lightning* and a few other disk-caching programs, the announced-but-undelivered-at-this-writing *SideKick Plus*, and that's all, folks. The L in LIM—excuse me, LIMA—stands for Lotus; it's goofy that neither its *Metro* nor its *Express* supports the spec nor is likely to in the foreseeable future.

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CIRCLE 121 ON READER SERVICE CARD

WHY CD-ROMS GET GRAY With its annual conferences and system and application software releases, Microsoft seems genuinely committed to demonstrating the potential of the CD-ROM. But the general line about CD-ROM players is that they're too expensive and too slow.

Price *is* definitely a problem; despite the drive manufacturers' claims, I'm convinced there's no excuse for CD-ROM players' costing three times as much as audio models from Crazy Eddie.

But if Microsoft wanted to showcase CD-ROM speed, it sure did a lousy job of it with *Bookshelf*. This multivolume reference set has the potential to be perhaps the single most useful writer's tool ever, but its implementation is brain-damaged. Worse, its slowness, which is mostly not the hardware's fault, may wrongly convince people that CD-ROMs are inherently too sluggish to be of much use.

The single best feature of *Bookshelf*'s dictionary is its ability to show you definitions in reverse—a writing (and thinking) tool utterly unavailable before. Fictioneers could find unusual headgear for an offbeat character by asking to see every term that includes the word *hat* in its definition. The same technique can zero in on a word whose existence you only dimly remember; it found me that *brumal* in the first paragraph.

This could be a wonderful tool for kids learning languages. It's also a perfect refutation of the "hypertext" concept of "linkage": here the computer creates "links" on demand rather than regurgitate what's been preconnected. Alas, it takes 10 minutes short of forever to use.

Bookshelf looks like a lame, out-the-door first pass. (Does its TSR mode use the expanded memory spec, whose third initial is M for Microsoft? Maybe in Release 2.) A pity, because better design could make the virtues of CD-ROM significantly clearer. So few copies of the current *Bookshelf* will actually get into circulation that Microsoft probably won't even get any silly complaints about the handy swear words in the dictionary.

And now, if you'll excuse me, I'm off to sniff the daisies and dust off the old mitt—provided I don't trip over all these nice warm transformer bricks on the way out.

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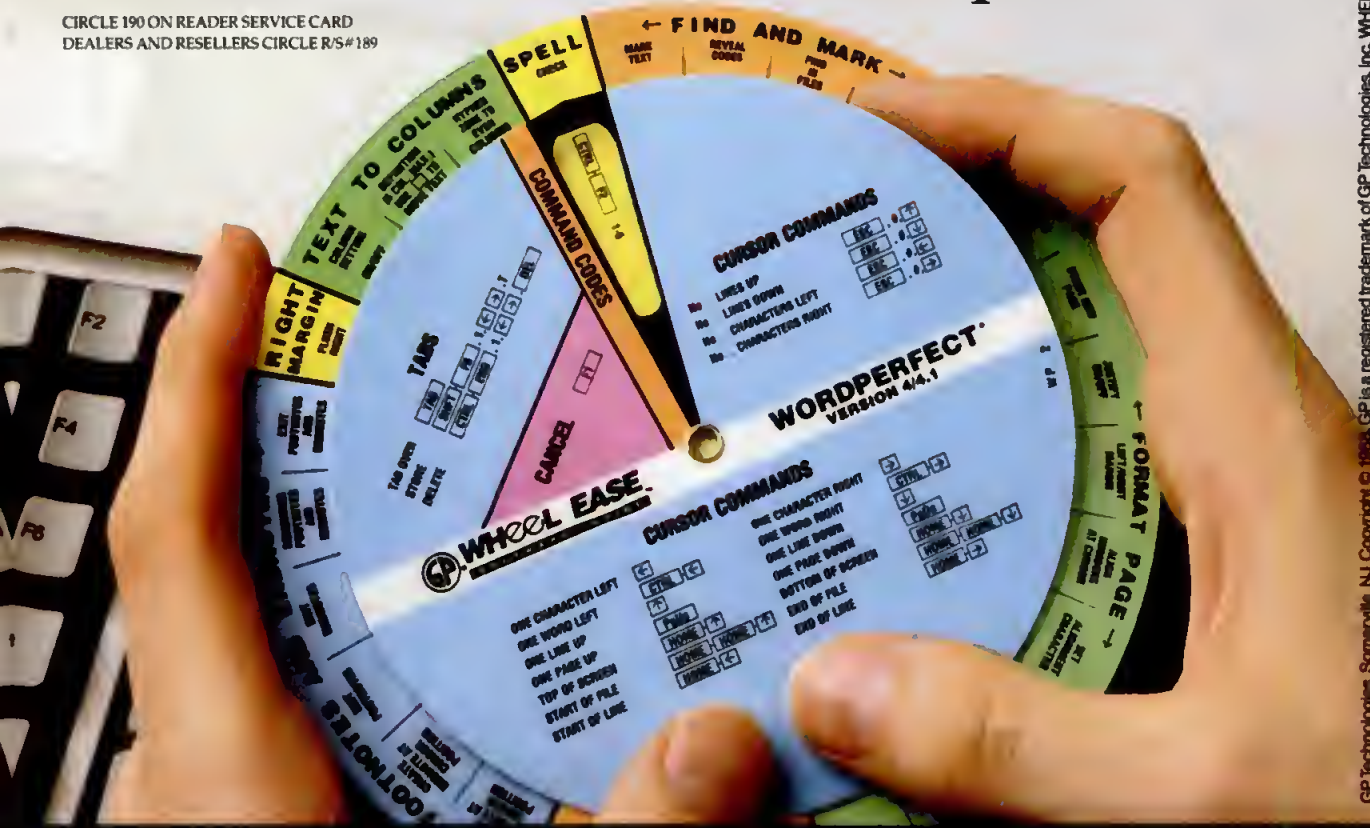
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CIRCLE 476 ON READER SERVICE CARD



PROGRAMMABLE DATABASES: dBASE AND ITS CHALLENGERS

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PC Magazine presents reviews of 43 programmable database managers, ranging in price from $39 to $1,495, that represent the state of the art in database software.

Over the last two issues, Project Database has examined flat-file database programs and relational database managers without integral programming languages. Both are important productivity tools.

But neither of those categories represents the programs most of us think of when we hear the phrase *database manager*. Neither is at or even near the cutting edge of software technology. And neither foreshadows the directions most experts think database software will be taking during the next few years.

Admission to that pantheon requires the hallmarks of the programs reviewed in this installment of Project Database: programs having not only relational design (in most cases) but also a programming language, to allow end users and systems developers to build complex systems, write and use canned procedures, and generally take the finished system beyond what's possible with database products that don't have their own languages.

DATABASE DESIGN Forgive the obvious, but if those are the criteria for inclusion in this group, it's worth taking a moment to consider both the idea of relationality and the nature of DBMS programming languages.

Database systems capable of dealing with large amounts of data generally fall into three categories: hierarchical, network, and relational.

The hierarchical design, long the standard in the mainframe world, has largely been superseded by relational products. But hierarchical database systems can work very well. And those that have programming languages are reviewed in this issue alongside the programmable relationals.

Hierarchical databases organize data into highly structured "master-slave" or

"grandfather-father-son" arrangements. Where this kind of structure is natural, or organic, to the data being managed, hierarchical DBMS systems work well, with efficient use of disk space and reasonably fast inquiries. Unfortunately, users must generally know all about the hierarchical structure, because looking up data, or "querying the database," requires commands that trace the tree to the appropriate level for the data sought.

The mainframe program Focus and its personal computer offspring, *PC/Focus* (reviewed in this issue), use a hierarchical approach, though the PC version relies a bit on the relational model as well.

THE NETWORK MODEL The second major category of database systems uses the network design. This uses mathematical set theory and, while capable of managing very large problems, requires a great deal of planning—and especially, comprehensive knowledge about the nature of the data to be organized—before the database is built.

■ The relational model grows out of the work of Dr. Edgar Codd, an IBM Fellow.

The network idea is actually an extension of the hierarchical approach (in that data subsets may appear to be hierarchically organized). Sets have ownership and membership properties, and a series of many-to-many relationships among sets can be supported. Among the programmable network databases reviewed in this issue is *db_Vista III* from Raima Corp., a tool intended for C programmers. Of note is Raima's *db_Query*, an SQL-based interface to *db_Vista* that provides a relational view of this network database.

The best-known PC database that uses the network model is *MDBS III* from mdbs Inc. (the developer of *KnowledgeMan/2*), which is remarkably powerful—as long as you're sure you understand enough about the innate structure of the data *before* you begin building the system, and you're equally sure you won't face substantial restructuring of that data *after* the system is built. Priced at $3,900 for the base package, which includes a data dictionary, programming language, and the high-level language interface of your choice, it's also remarkably expensive and was not reviewed for that reason.

RELATIONALITY The relational model grows out of the work of Dr. Edgar Codd, an IBM Fellow. First published in an internal IBM paper in August 1969, then in a seminal paper in the *Communications of the ACM* in June 1970, his relational model allows concurrent access to multiple datafiles, as long as those files are related through common fields.

CUSTNO, for example, might thus be common to both the INVOICES and ACTSRCV files; PARTNO might be common to the INVOICES and INVENTRY files; and VENDNO might be common to the INVENTRY and REORDER files. If so, data from all those files could be drawn together in a single report, through the "relations" bridging the several files. (For more on the relational model, see "Relational Databases: Taking the Middle Ground," in the previous installment of Project Database 3, *PC Magazine*, April 26, 1988.)

Codd's definition of *relationality* is far more strict than that generally applied in the PC database business. While we call programs such as *dBASE* "relational," Codd argues at length that this is hardly faithful to his vision. Indeed, Codd is not happy with the extent to which any existing mainframe or PC database products have implemented his relational model. But Codd does have hope for the next generation of PC DBMS packages, especially in the technology developed by Nucleus, a Santa Monica start-up that hopes to bring its database technology to market in mainframe and PC products produced by OEMs later this year.

AND LANGUAGES There are computer languages and there are database languages. For example, although some of these database programs provide libraries of routines that allow calls from high-level programming languages such as C, those routines are not the integral languages we speak of when referring to programmable databases.

Such "hooks" for external, conventional languages are boons for systems developers who need to link databases to other, existing systems. (And for programs that do not provide such internal links to standard external languages, add-on products such as Synchronicity Research's exceptional *Rbridge* for Microrim's *R:base* products can add them. *Rbridge*, for example, allows access to *R:base* files from Borland's Turbo Pascal, C, and BASIC, and Microsoft's Quick C and Quick BASIC.)

But including hooks for external languages does not a programmable DBMS make.

The integral programming languages that count in DBMS products are classified as procedural and nonprocedural. A simple definition of the distinction is that nonprocedural languages allow you to tell the program *what* you want done; procedural languages require you to tell the computer *how* to do it.

For example, a procedural DBMS language would use a series of BASIC-like commands to Use a database, Select from it records meeting certain criteria, Sort them according to the desired pattern, then Display them on the screen.

While procedural languages carry the substantial disadvantage of requiring users to know those commands and the proper syntax, and the names and perhaps the structure of the databases in use, they also have advantages for systems developers. For example, they can be used to write libraries of canned routines that are used over and over again for repetitive tasks. And that very structure that may bedevil a user is what makes possible calls from standard programming languages outside the system.

Nonprocedural languages, on the other hand, support end users by offering fill-in-the-blanks screens for retrieving information, or menus from which users may choose specific items. Often mistakenly called fourth-generation languages (or "4GLs"), they also typically offer global commands, such as List_All, which would lead to chaos in procedural languages.

As easy as nonprocedural languages are for the nonprofessional to use, they're less satisfactory for those developing systems built around them: someone has to *create* all those menus and fill-in-the-blanks screens. And because in the process of designing those screens and menus the developer/programmer must make choices about the kinds of operations likely to be undertaken through them, many experts argue that nonprocedural languages are inherently more limiting for the end user—and less amenable to narrow, precise inquiries—than the enigmatic but highly specific syntax of a procedural statement.

NOW TELL ME... No matter how a database is designed, the reason for its existence is to answer users' questions, or "queries." And the languages used for querying high-end databases are as diverse as their inherent design and programming languages. Today the battle is between SQL, or Structured Query Language, and QBE, or Query By Example.

SQL grows out of work by D. D. Chamberlin and others at IBM's Research Laboratory in San Jose, California. As with many "standards," it's hard now to tell what's truly SQL and what isn't. The emerging standard has been fragmented by products that claim to be SQL-based but clearly aren't, other products that say they're somewhat SQL-ish but are trying to get better, and the inevitable scurrying about by committees and professional organizations, trying to establish certain versions or dialects as *the* standard.

The great advantage of SQL design is that PC products with full SQL implementations can directly query mainframe databases such as IBM's *DB2*, which expect to see SQL inquiries. SQL queries will probably also be de rigueur for using the emerging database-server products coming from Microsoft, Ashton-Tate, Sybase, Lotus, Gupta, and others this year.

QBE is also an IBM idea, growing from work led by M. M. Zloof at IBM's Research Laboratory in Yorktown Heights, New York. It has great appeal for those put off by the need to learn SQL commands and syntax—and how to knit together SQL statements or requests.

By contrast, QBE presents users a visual image of a single-row data table, with one space for every field in the database. Among PC products, QBE is best exemplified by *Paradox*, a package that brilliantly combines a *Lotus 1-2-3*–like menuing and command system with true QBE querying.

In *Paradox*, the PC user simply moves the cursor across the screen, leaving check marks (actually the square root sign from the IBM extended character set) in fields where answers are desired. Specific examples—the *E* of QBE—are given in the form used to enter data into the database, to indicate selection criteria. Thus, to retrieve all records for people with the last name *Howard*, the word *Howard* would be entered into the LName field.

Quantifiable selection criteria are similarly entered as greater-than, less-than, equal-to, and not-equal-to expressions. *Paradox* returns an "answer table," which in the best Codd relational style can itself be the basis for further inquiries.

The battle between QBE and SQL may be over; SQL's dominance in the mainframe world means that QBE-based products such as *Paradox* are adding alternative SQL capabilities, without removing the QBE design so justifiably popular with their users.

THE dBASE CASE Its adherents and antagonists alike agree that *dBASE* is the best-known, most widely used program in the programmable relational group. Based on *Vulcan*, an early, pioneering microcomputer program written by Wayne Ratliff while he was working at California's Jet Propulsion Lab, *dBASE II* has grown from a limited and only marginally relational program to today's *dBASE III Plus*—a sophisticated package that so thoroughly dominates the PC database market as to define it for many users.

Whatever its strengths, shortcomings, and future, the historical development of *dBASE* is instructive in understanding the dynamics and loyalties of the high-end DBMS marketplace.

In the beginning, *dBASE*'s success came mainly from its being almost alone at the high end of PC database programs, and from a brilliant marketing effort engineered by George Tate and Hal Lashlee, the heads of Ashton-Tate. Even though the program has grown and changed more slowly than many of its users and critics wished, it has nonetheless evolved at a sufficiently rapid pace to hold on to its market leadership.

What, *dBASE II* could only open two database files at once? OK: How about ten under *dBASE III?* You don't like encountering the trademark "dot prompt," instead of the familiar and theoretically more friendly "C>"? Boot up *dBASE III Plus* and go into its Assistant mode, and you'll find a series of warm, cuddly drop-down menus instead of that cold, lonely period. Want help designing input screens? It's there in *dBASE III Plus*. Tired of writing a program just to get mailing labels out of your *dBASE* database? The process of printing labels has been automated for you in *dBASE III Plus*.

Still think *dBASE* hasn't changed fast enough? You may be right, but lots of buyers think *dBASE* is just fine, thank you. IMS America's Ron Rehling says that according to this group's surveys, *dBASE III Plus* was the fourth-largest-selling program, in dollars, through computer stores during the last half of 1987. (The win/place/show titles? *Lotus 1-2-3*, *DisplayWrite 4*, and *WordPerfect*.)

If both *dBASE*'s early success and the foundation then laid for its continuing dominance grew out of standing almost alone at the top, seriously challenged only by *Condor* in those halcyon days, its latter-day success owes much to the huge corps of *dBASE*-like and *dBASE*-extender products that have appeared on the scene to tame the beast, extend it, improve its performance, and make its benefits available at lower cost.

Beginning with Fox and Geller's pioneering code-writing and report-writing add-ons (*Quickcode*, *Quickreport*, and so forth), the third-party-developer community has buoyed *dBASE*'s growth into the PC standard. With compilers such as Nantucket's *Clipper* and Wordtech's *Quicksilver*, program generators such as Bytel's *Genifer*, complete alternative interpreters such as Wordtech's *dBXL*, and many, many more, *dBASE*'s momentum has continued.

HAS dBASE BEEN dBASEd? Indeed, these days when someone says he or his company uses *dBASE*, it's worth asking if

Programmable Databases: Summary of Features

(Products listed in ascending price order)

	1 on 1 = 3ff $39.00	VP-Info $124.95	VerseForm XL $159.00	d8XL Diamond Release $199.00	Magic PC $199.00	d8MAN $249.95	DB-Fahs $295.00	Open Access II $295.00
Program type	Relational	Relational	Relational	Relational	Relational	Relational	Relational	Relational
PROGRAM SIZE								
Installed program size (kilobytes)	1,500	395	1,000	1,250	485	320	500	595
Min. no. of program files	1	1	1	2	1	1	1	2
FILE STRUCTURE LIMITS								
Field size (characters)	254	254	78	254	2,048	254	255	78
Fields per record	128	256	150	128	2,048	128	64	100
Fields per database	896	256	750	Unlimited	Unlimited	Unlimited	64	100
Record size (bytes)	4,000	8,000	8,000	4,000	2,048	4,000	32,240	2,048
Records per data file	1 billion	65,535	30,000	1 billion	Unlimited	2 billion	65,535	Unlimited
No. of data files per database	Unlimited	1	1	10	999	10	6	8
Records per database	Unlimited	65,535	Unlimited	1 billion	Unlimited	2 billion	65,535	Unlimited
DATA FIELD TYPES AND MAXIMUM SIZES								
Character fields (characters)	● (254)	● (255)	● (78)	● (254)	● (2,048)	● (254)	● (255)	● (78)
Long text fields (characters)	● (64,000)	● (unlimited)	○	● (10,000)	● (2,048)	○	○	○
Numeric fields (digits)	● (16)	● (20)	● (22)	● (19)	● (14)	● (15)	● (14)	● (18)
Currency fields (characters)	○	○	○	○	○	○	○	○
Date fields	● (8 characters)	○	● (8 characters)	● (8 characters)	● (8 bytes)	● (8 characters)	○	● (10 characters)
Time fields	○	○	○	○	● (4 bytes)	○	○	○
Boolean fields (characters)	● (1)	● (1)	○	● (1)	○	● (1)	○	● (2)
Other fields	None	None	Integer	None	None	None	None	Scientific
DATA FIELD ATTRIBUTES								
Tests for valid data ranges	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)
Provides default values	●	●	●	●	●	●	○	●
Checks for specific values	● (user-defined)	● (user-defined)	● (user-defined)	○	● (user-defined)	● (user-defined)	○	● (automatic)
Verifies data via a lookup table	●	●	●	○	●	●	○	●
Provides automatic data entry from lookup table	● (user-defined)	● (user-defined)	● (user-defined)	○	● (user-defined)	● (user-defined)	○	● (automatic)
Double-entry verification	● (user-defined)	● (user-defined)	● (user-defined)	○	● (user-defined)	● (user-defined)	○	○
Requires all fields to be filled	● (user-defined)	● (user-defined)	● (user-defined)	○	● (automatic)	● (user-defined)	○	● (automatic)
Offers "forced uppercase" option	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)
Converts date formats	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	○	● (automatic)
Increments fields	● (user-defined)	○	● (user-defined)	○	● (user-defined)	● (user-defined)	○	● (automatic)
Unique fields	● (user-defined)	● (user-defined)	● (automatic)	○	● (user-defined)	● (user-defined)	○	● (automatic)
Fixed values for data entry fields	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	○	○

—Indicates Editor's Choice ●—Yes ○—No

DataEdge	D the date language	Farmele IV	FoxBeee Plee	Wetfile/Plee	Condor 3	Ramis/PC Work-stetion	db_Vista III	Knowt-adga-Man/2	NPL/R	Q-Pro 4
$395.00	$395.00	$395.00	$395.00	$395.00	$495 00	$495.00	$595.00	$595 00	$595 00	$595 00
Hierarchical	Relational	Relational	Relational	Relational	Relationaf	Relational	Network	Relational	Relational	Network
1,200	663	681	650	284	325	2,500	800	850	340	558
3	6	40	1	1	4	4	2	1	2	3
254	Unlimited	127	254	79	127	75	Unlimited	65,535	999	255
500	Unlimited	200	128	Unlimited	127	255	Unlimited	255	255	Unlimited
4,080	Unlimited	Unlimited	128	Unlimited	8,322,818	255	Unlimited	255	Unlimited	Unlimited
27,808	4,088	10,240	4,000	Unlimited	1,024	4,000	Unlimited	65,535	10,000	64,000
Unlimited	Unlimited	Unlimited	1 billion	32,766	65,534	Unlimited	16 million	1 billion	Unlimited	2 billion
Unlimited	Unlimited	Unlimited	Unlimited	1	65,534	Unlimited	Unlimited	1	Unlimited	255
Unfimited	Unlimited	Unlimited	Unlimited	32,766	65,534	Unlimited	Unlimited	1 billion	Unlimited	2 billion
● (254)	● (unlimited)	● (127)	● (254)	● (79)	● (127)	● (75)	● (unlimited)	● (65,534)	● (255)	● (255)
○	● (unlimited)	○	● (512)	○	○	○	● (unlimited)	● (65,534)	● (999)	○
● (15)	● (unlimited)	● (4)	● (19)	● (30)	● (20)	● (70)	● (14)	● (14)	● (32)	● (255)
○	○	○	○	● (30)	● (12)	● (75)	○	○	● (13)	○
● (254 characters)	○	● (4 characters)	● (8 characters)	● (10 characters)	● (8 characters)	● (8 characters)	○	○	● (6 bytes)	○
○	○	○	○	○	○	● (8 charactars)	○	○	● (4 bytes)	○
● (254)	○	● (1)	● (1)	○	○	○	○	● (1)	○	○
None	Integer, double integer	Spare field	None	None	None	Alpha	Unlimited	None	None	None
● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	○
●	●	●	○	○	●	●	●	●	●	○
● (user-defined)	● (user-defined)	● (user-defined)	○	● (user-defined)	○	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	○
●	●	●	○	○	○	●	●	●	●	○
○	● (user-defined)	● (user-defined)	○	○	○	● (user-dafined)	● (user-defined)	● (user-defined)	● (automatic)	○
○	● (user-defined)	● (user-defined)	○	○	○	○	● (user-defined)	● (user-defined)	● (automatic)	○
● (user-defined)	● (user-defined)	● (user-defined)	○	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	● (user-defined)
○	● (user-defined)	● (user-defined)	○	○	○	○	● (user-defined)	● (user-defined)	● (automatic)	○
○	● (user-defined)	● (user-defined)	○	○	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	○
○	● (user-defined)	● (user-defined)	○	○	○	● (user-defined)	● (user-defined)	● (user-defined)	○	○
● (automatic)	● (user-defined)	● (user-defined)	○	○	● (automatic)	● (user-dafined)	● (automatic)	● (user-defined)	● (automatic)	○
● (user-defined)	● (user-defined)	● (user-defined)	○	○	● (user-defined)	● (user-dafined)	● (user-defined)	● (user-defined)	● (automatic)	○

(continues)

Programmable Databases: Summary of Features

(Products listed in ascending price order)

	Quicksilver Diamond Release $599.00	DataEase $600.00	The D'Hanlon Database Solution $650.00	Clipper $695.00	DataFlex $695.00	dBASE III Plus $695.00	The Smart Data Base Manager $695.00	PRODAS $720.00
Program type	Relational	Network	Relational	Relational	Relational	Relational	Relational	Relational
PROGRAM SIZE								
Installed program size (kilobytes)	2,310	600	1,000	1,287	1,500	600	796	1,500
Min. no. of program files	2	10	3	1	2	1	2	1
FILE STRUCTURE LIMITS								
Field size (characters)	254	255	255	32,000	255	254	1,000	200
Fields per record	128	255	1,000	1,028	255	128	255	Unlimited
Fields per database	Unlimited	65,000	Unlimited	1,028	65,535	128	Unlimited	Unlimited
Record size (bytes)	4,000	4,000	26,496	65.8 million	18,000	4,000	4,096	64,000
Records per data file	1 billion	65,535	16.7 million	1 billion	16.7 million	1 billion	999,999	Unlimited
No. of data files per database	10	255	Unlimited	1	250	Unlimited	Unlimited	Unlimited
Records per database	1 billion	65,535	Unlimited	Unlimited	16.7 million	Unlimited	999,999	Unlimited
DATA FIELD TYPES AND MAXIMUM SIZES								
Character fields (characters)	● (254)	● (255)	● (255)	● (32,000)	● (255)	● (254)	● (1,000)	● (200)
Long text fields (characters)	● (10,000)	● (4,000)	○	● (64,000)	○	● (512)	○	○
Numeric fields (digits)	● (19)	● (14)	● (14)	● (19)	● (22)	● (19)	● (18)	● (18)
Currency fields (characters)	○	● (14)	● (11)	○	● (22)	○	○	● (18)
Date fields	● (8 characters)	● (8 characters)	● (8 characters)	● (8 characters)	● (10 characters)	● (8 characters)	● (8 characters)	● (8 bytes)
Time fields	○	● (8 characters)	● (8 characters)	○	○	○	● (9 characters)	● (8 bytes)
Boolean fields (characters)	● (1)	● (1)	○	● (1)	● (1)	● (1)	○	● (200)
Other fields	None	Choice, numeric string	Overlay	None	None	None	Counter, inverted name, phone, Social Security	None
DATA FIELD ATTRIBUTES								
Tests for valid data ranges	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	●	● (user-defined)	● (user-defined)
Provides default values	●	●	●	●	●	○	●	●
Checks for specific values	○	● (user-defined)	● (automatic)	○	● (user-defined)	○	● (user-defined)	● (automatic)
Verifies data via a lookup table	○	●	●	○	●	○	●	●
Provides automatic data entry from lookup table	○	● (user-defined)	● (user-defined)	○	● (user-defined)	○	● (user-defined)	● (user-defined)
Double-entry verification	○	○	● (user-defined)	○	● (user-defined)	○	● (user-defined)	● (user-defined)
Requires all fields to be filled	○	● (user-defined)	● (automatic)	● (user-defined)	● (automatic)	○	● (user-defined)	● (automatic)
Offers "forced uppercase" option	● (user-defined)	○	● (automatic)	● (user-defined)	● (automatic)	○	● (user-defined)	● (user-defined)
Converts date formats	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	○	● (automatic)	● (user-defined)
Increments fields	○	● (user-defined)	● (user-defined)	○	● (user-defined)	○	● (automatic)	● (user-defined)
Unique fields	○	● (user-defined)	● (user-defined)	○	● (automatic)	○	● (user-defined)	● (user-defined)
Fixed values for data entry fields	● (user-defined)	● (user-defined)	● (user-defined)	○	● (user-defined)	○	● (user-defined)	● (user-defined)

—Indicates Editor's Choice ●—Yes ○—No

Paradox	R:base for OOS	Omnis Quartz	Team-Up	Zim	Advanced Revelation	B.O.S.S.	filePro 16 Plus	Progress	PC/Focus	pcExpress
$725.00	$725.00	$795 00	$795 00	$880.00	$950.00	$990.00	$990 00	$1,000 00	$1,295.00	$1,495.00
Relational	Relational	Relational	Hierarchical	Network	Relational	Relational	Relational	Relational	Hierarchical	Relational
1,000	4,000	542 2	1,300	2,322	300	892	1,899	3,650	3,500	2,500
1	3	2	3	1	4	2	5	3	1	1
255	4,096	2,400	8,000	32,000	64,000	255	999	255	256	Unlimited
255	800	120	1,000	16,000	32,000	255	999	Unlimited	512	Unlimited
255	800	7,200	Unlimited	Untimited	Untimited	255	999	Unlimited	Unlimited	Untimited
4,000	1,532	30,000	8,000	32,000	64,000	60,000	16,384	2,000	128,000	Untimited
2 billion	Unlimited	Untimited	Unlimited	Unlimited	Untimited	Unlimited	16 million	Unlimited	Unlimited	Unlimited
1	80	60	255	Unlimited	Untimited	1	16 million	1,024	64	Unlimited
2 billion	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	4 billion	16 million	Unlimited	Unlimited	Unlimited
● (255)	● (1,500)	● (2,400)	● (8,000)	● (32,000)	● (64,000)	● (255)	● (999)	● (255)	● (255)	● (unlimited)
○	● (4,050)	● (2,400)	● (8,000)	● (32,000)	● (64,000)	● (60,000)	● (999)	○	○	● (unlimited)
● (15)	● (9)	● (11)	● (18)	● (20)	● (14)	● (14)	● (24)	● (50)	● (9)	● (15)
● (15)	● (16)	○	● (18)	○	● (14)	○	● (18)	○	● (15)	○
● (11 characters)	● (30 characters)	● (8 characters)	● (10 characters)	● (8 characters)	● (14 characters)	● (8 characters)	● (10 characters)	● (8 characters)	● (unlimited)	○
○	● (20 characters)	○	● (8 characters)	○	● (10 characters)	○	● (8 characters)	○	○	○
○	○	● (1)	○	○	● (1)	● (1)	○	● (unlimited)	○	● (1)
Integer	Integer, double integer	National	None	None	None	None	None	Array	None	None
● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (automatic)	● (automatic)	● (user-defined)
● (user-defined)	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (automatic)	● (user-defined)	● (automatic)
●	●	●	●	●	●	●	●	●	●	●
● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	○
● (user-defined)	● (user-defined)	○	● (automatic)	● (automatic)	● (user-defined)	● (user-defined)	○	● (user-defined)	● (user-defined)	● (user-defined)
● (user-defined)	● (automatic)	● (user-defined)	○	● (automatic)	● (automatic)	● (user-defined)	● (automatic)	● (automatic)	● (user-defined)	● (user-defined)
● (user-defined)	● (user-defined)	● (user-defined)	○	● (automatic)	● (automatic)	● (user-defined)	● (automatic)	● (automatic)	● (automatic)	● (automatic)
● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (automatic)	● (automatic)	● (automatic)	● (automatic)	● (user-defined)	● (automatic)	● (user-defined)
● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)
● (automatic)	● (automatic)	● (user-defined)	● (user-defined)	● (automatic)	● (automatic)	● (user-defined)	○	● (user-defined)	● (automatic)	● (automatic)
● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	○	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)

(continues)

Programmable Databases: Summary of Features

(Products listed in ascending price order)

	1 on 1 = 3ii $39.00	VP-Info $124.95	VersaForm XL $159.00	dBXL Diamond Release $199.00	Magic PC $199.00	d8MAN $249.95	D8-Fsbs $295.00	Open Access II $295.00
Calculated fields on entry screen	●	●	●	○	●	●	●	●
Carryover from previous record	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	● (automatic)	● (automatic)
Error handling	● (user-defined)	● (automatic)	● (user-defined)	○	● (user-defined)	○	● (user-defined)	● (automatic)
Data dictionary/catalog	● (automatic)	○	○	○	● (automatic)	○	● (automatic)	● (automatic)
User-accessible data dictionary	● (automatic)	○	○	○	● (automatic)	○	● (automatic)	● (automatic)
DATA IMPORT EXPORT								
DIF	○/○	○/○	○/○	●/●	○/○	●/●	●/●	●/●
DBF	●/●	●/●	○/○	●/●	○/○	●/●	●/○	●/○
PFS	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○
SDF	●/●	●/●	○/●	●/●	●/●	●/●	○/○	●/○
SYLK	○/○	○/○	○/○	●/●	○/○	○/○	○/○	○/○
WKS	○/○	○/○	○/○	●/●	○/○	○/○	○/○	●/●
ASCII	●/●	●/●	○/●	●/●	●/●	●/●	●/●	●/●
DB2 and SQL/DS	○/○	○/○	●/○	○/○	○/○	●/○	○/○	○/○
User-defined	○/○	●/●	○/○	●/●	○/○	○/○	●/○	○/○
Specific minicomputer format	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○
Specific mainframe format	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○
DATA MANIPULATION								
Max. no. of indexing fields	Unlimited	60	2	50	24	Unlimited	Unlimited	100
Max. no. of compound indexes	Unlimited	60	2	50	24	70	Unlimited	N/A
Unique index value	○	○	●	○	○	○	●	○
Respecify indexed fields	●	●	○	●	●	●	●	●
Automatic index maintenance	●	●	●	○	●	●	●	●
Respecify file definition	●	●	●	●	●	●	●	●
Multiple record deletions	●	●	●	●	●	●	●	●
Multiple record updates	●	●	●	●	●	●	●	●
Math updates	●	●	●	●	●	●	●	●
Text updates	●	●	●	●	●	●	●	●
Max. no. of view tables	7	N/A	Unlimited	1	Unlimited	10	2	8
Max. no. of join tables	2	6	Unlimited	2	Unlimited	10	2	8
Max. no. of project tables	7	6	Unlimited	9	Unlimited	10	2	1
Max. no. of union tables	2	6	Unlimited	2	Unlimited	10	2	8
Max. no. of intersect tables	7	6	N/A	2	Unlimited	10	2	8
Max. no. of append tables	2	6	Unlimited	1	Unlimited	2	2	8
Max. no. of open data files	7	6	2	10	15	10	6	Unlimited
SORTING								
Permanent	●	●	○	●	●	●	●	●
Temporary (for duration of command)	○	●	●	○	●	○	○	○
Sorts on any field	●	●	●	●	●	●	●	○
Sorts on indexed field only	○	○	○	○	○	○	○	●
Max. no. of fields sorted at once	Unlimited	255	3	50	18	7	Unlimited	5

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable program does not have this feature

DataEdge	D the data language	Formula IV	FoxBase Plus	Waffle/Plus	Condor 3	Ramis/PC Work-station	db_Vista III	Knowl-edge-Man/2	NPL/R	Q-Pro 4
$395.00	$395.00	$395.00	$395.00	$395.00	$495.00	$495.00	$595.00	$595.00	$595.00	$595.00
●	●	●	○	○	○	●	●	●	○	○
○	● (user-defined)	● (user-defined)	○	● (automatic)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)	● (automatic)
● (automatic)	● (user-defined)	● (user-defined)	○	○	● (automatic)	● (automatic)	● (user-defined)	● (user-defined)	● (user-defined)	● (automatic)
● (automatic)	● (user-defined)	○	● (automatic)	● (automatic)	● (automatic)	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (automatic)
● (automatic)	● (user-defined)	○	● (automatic)	● (automatic)	● (automatic)	● (user-defined)	● (automatic)	● (user-defined)	● (user-defined)	● (automatic)
○/○	●/●	○/○	○/○	●/●	○/○	●/●	○/●	●/●	○/●	○/○
●/○	●/●	○/○	●/●	○/○	○/○	●/●	○/○	○/○	●/●	●/●
○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○
●/●	●/●	○/○	●/●	●/●	●/●	○/○	○/●	●/●	●/●	●/●
○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○
○/○	○/○	○/○	○/○	○/○	○/○	●/●	○/○	○/○	○/○	●/●
●/●	●/●	●/●	●/●	●/●	●/●	●/●	●/●	●/●	●/●	●/●
○/○	○/○	○/○	○/○	○/○	○/●	●/●	○/○	○/○	○/○	○/○
●/●	●/●	○/●	○/○	○/○	●/●	●/●	○/○	○/○	○/●	○/○
○/○	●/●	○/○	○/○	○/○	●/●	●/●	○/○	○/○	○/○	○/○
○/○	●/●	○/○	○/○	○/○	●/●	●/●	○/○	○/○	●/●	○/○
9	Untimited	Unlimited	Unlimited	N/A	8	25	Unlimited	Unlimited	40	60
N/A	N/A	Unlimited	Unlimited	N/A	8	4	Unlimited	Unlimited	Uniimited	60
○	○	○	●	○	●	○	●	○	●	●
●	●	●	●	○	●	●	●	●	●	●
●	●	●	○	○	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
1	Unlimited	Unlimited	N/A	N/A	1	99	Unlimited	N/A	16	255
16	Unlimited	11	2	2	2	12	Unlimited	44	16	255
1	Unlimited	11	2	1	2	2	Unlimited	44	16	255
N/A	Unlimited	11	2	2	N/A	2	Unlimited	44	16	255
N/A	Unlimited	11	2	2	2	2	Unlimited	44	16	255
1	Unlimited	2	1	2	2	2	Unlimited	44	Unlimited	255
112	Unlimited	12	10	2	3	12	16	45	16	255
●	○	●	●	●	●	●	●	●	●	○
○	●	○	○	●	●	○	○	●	●	●
○	●	●	●	●	●	●	●	●	●	●
●	○	○	○	○	○	○	○	○	○	○
9	Unlimited	Unlimited	Unlimited	Unlimited	32	9	Unlimited	Unlimited	Unlimited	60

(continues)

A lot of computer for your money





Bentley-286/12

Base System.....$1295

12MHz 80286 processor, 1MB RAM, 1.2MB floppy drive, dual floppy/hard drive controller, 200-watt power supply, and keyboard.

- **With 40MB HD MiniScribe, 28ms $1845**
- **With 70MB HD MiniScribe, 28ms $2089**

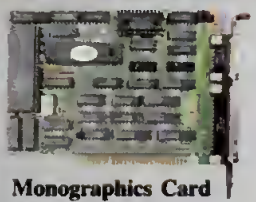
Bentley-286/10

Base System.....$1045

10MHz 80286 processor, Phoenix® BIOS, 512KB RAM, 1.2MB floppy drive, dual floppy/hard drive controller, 200-watt power supply, and keyboard.

- **With 40MB HD MiniScribe, 28ms $1595**
- **With 70MB HD MiniScribe, 28ms $1839**

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Monographics Card
Text mode 80 col x 25 rows graphics mode 720 x 348, parallel port..... **$65**



Samsung
12" flat screen with tilt and swivel base ... **$95**

Mono Combo
Monographics card and monitor **$139**



EGA Card
640 x 350, 256KB display RAM **$149**



EGA Monitor
14" tube, 13" diagonal high-resolution **$349**

EGA Combo
EGA card and monitor..... **$479**



Color Card
High resolution color graphics card **$69**



Color Monitor
14" tube, CGA monitor **$279**

Color Combo
CGA card and monitor **$329**



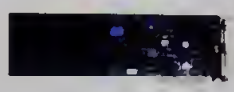
NEC Multisync II-The elite monitor. Adjusts to any horizontal frequency between 15.5KHz and 31.77KHz. Resolution up to 800 x 675, and supports both analog and TTL inputs. Thirteen-inch screen.
Only **$599**



Modems-All Bentley modems are compatible with all popular communication standards and have auto answer, auto redial, and auto voice/data switching. External modems include LED status indicators and require modem cable for hookup.

300/1200 Baud Internal Modem.....$69
300/1200/2400 Baud Internal Modem....$139
300/1200 Baud External Modem $89
2400 Baud External Modem ...$159

More memory, more power...



XT-MFC-A six-function expansion card: 384KB RAM, serial port, parallel port, game port, clock-calendar with battery backup, and utility software.
Only **$199**



AT-MFC-for IBM PC AT® Up to 1.5MB memory expansion, serial & parallel port. Comes with 0KB.
Only **$139**



MEM-576-Memory expansion card that fits in a short slot and supports either 64KB or 256KB chips. Comes with 0KB, expandable to 192KB, 284KB or 576KB.
Only **$35**

Memory Chips-(Sets of 9)
256K chips (150ns).....**$40**
256K chips (120ns).....**$42**
256K chips (100ns).....**$46**



EMS-Expanded-Memory-Specification card compatible with the Lotus/Intel/Microsoft memory specification. Comes with 0KB, expandable to 2MB. Includes utility software.
PC Version
Only **$99**
AT Version
Only.....**$119**

Coprocessors
8087-3 (5MHz) **$129**
8087-2 (8MHz) **$159**
80287-6 (6MHz) **$219**
80287-8 (8MHz) **$269**
80287-10 (10MHz).....**$349**

AT I/O-Serial port and parallel port.
Only **$59**

PC I/O-Serial port, parallel port, game port, and clock-calendar with battery backup.
Only **$65**

... plus a one-year warranty!



Bentley-286/8

Base System **$995**

8MHz 80286 processor, Phoenix BIOS, 512KB RAM, 1.2MB floppy drive, dual floppy/hard drive controller, 200-watt power supply, and keyboard.

- **With 20MB HD Seagate, 65ms** **$1291**
- **With 40MB HD MiniScribe, 28ms** **$1541**



Bentley Turbo-10

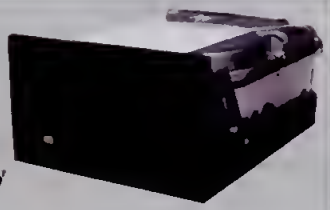
Base System **$549**

Turbo-charged XT-compatible 8088 processor running at 10MHz, 640KB RAM, one 360KB floppy drive and controller, eight expansion slots, 150-watt power supply, and keyboard.

- **With 30MB HD MiniScribe, 55ms** **$879**
- **With 40MB HD MiniScribe, 61ms** **$939**

Enhance your Bentley-286 with our popular AT add-on products!

MiniScribe Hard Disk Drives



High Quality • High Storage Capacity
High Performance • Low Price

One-Year Warranty

Both drives feature an average access time of 28 milliseconds. The drives' positioning systems use a rugged linear voice coil actuator that eliminates head skew problems. Microprocessor-aided control provides fast, accurate head positioning. Superior head/disk tracking is achieved through the use of Whitney technology head sliders and flexures. With MiniScribe's fail-safe actuator lock, the head positioner is retracted and locked at power-down, eliminating data zone contact. Partitioning software is included so you can take advantage of the full storage capacity.

42MB ..... **$569** **70MB** **$799**



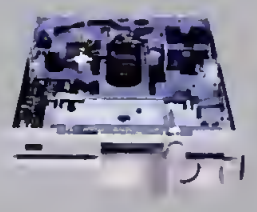
Internal Tape Backups-Avoid disk swapping; use streaming tape for your IBM PC®, PC AT®, or compatible.

20MB For the PC ... **$389** **60MB** For the AT **$757**



PC Hard Disk Kits-
Quality 30MB and 40MB hard disk kits for the IBM PC and compatibles. Each kit includes a half-height Winchester hard disk, hard disk controller, cables, software, mounting hardware, and complete illustrated installation manual.

30MB MiniScribe (55ms) **$339**
40MB MiniScribe (61ms) **$399**
20MB For the Compaq Portable **$299**



360KB Diskette Drives-
Convenience and compatibility.

For PCs **$99**
For ATs **$109**

Bentley Computer Products

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Tech Support: 512-250-8202

Programmable Databases: Summary of Features

(Products listed in ascending price order)

	Quicksilver Diamond Release $599.00	DataEase $600.00	The D'Hedge Database Solution $650.00	Clipper $695.00	DataFlex $695.00	dBASE III Plus $695.00	The Smart Data Base Manager $695.00	PRODAS $720.00
Calculated fields on entry screen	○	●	●	●	●	○	●	●
Carryover from previous record	● (user-defined)	● (user-defined)	● (user-defined)	○	● (user-defined)	● (automatic)	● (user-defined)	● (automatic)
Error handling	○	● (automatic)	● (user-defined)	● (user-defined)	● (automatic)	● (automatic)	● (user-defined)	● (automatic)
Data dictionary/catalog	○	● (user-defined)	● (automatic)	● (automatic)	● (automatic)	● (automatic)	● (automatic)	● (automatic)
User-accessible data dictionary	○	○	● (automatic)	● (automatic)	● (automatic)	● (automatic)	○	● (automatic)
DATA IMPORT EXPORT								
DIF	●/●	●/●	○/●	○/○	○/○	●/●	●/●	●/●
DBF	●/●	●/○	○/○	●/●	●/○	●/●	●/●	●/●
PFS	○/○	○/○	○/○	○/○	○/○	●/●	○/○	○/○
BDF	●/●	●/●	○/○	●/●	○/○	●/●	●/●	○/○
SYLK	●/●	○/○	○/●	○/○	○/○	●/●	○/●	○/●
WKS	●/●	●/●	○/○	○/○	○/○	●/●	●/●	●/●
ASCII	●/●	●/●	○/●	●/●	○/○	●/●	●/●	●/●
DB2 and SQL/DS	○/○	●/○	●/○	○/○	○/○	●/●	○/○	●/○
User-defined	●/●	●/●	●/●	○/○	●/●	○/○	●/●	●/●
Specific minicomputer format	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○/○
Specific mainframe format	○/○	○/○	○/○	○/○	○/○	○/○	○/○	●/●
DATA MANIPULATION								
Max. no. of indexing fields	50	255	10	Unlimited	6	Unlimited	15	Unlimited
Max. no. of compound indexes	50	255	9	Unlimited	N/A	Unlimited	15	Unlimited
Unique index value	○	○	○	○	●	○	○	○
Respecify indexed fields	●	●	●	●	●	●	●	●
Automatic index maintenance	○	●	●	●	●	○	●	●
Respecify file definition	●	●	●	●	●	●	●	●
Multiple record deletions	●	●	●	●	●	●	●	●
Multiple record updates	●	●	●	●	●	●	●	●
Math updates	●	●	○	●	●	●	●	●
Text updates	●	●	○	●	●	●	●	●
Max. no. of view tables	1	N/A	N/A	N/A	9	Unlimited	2	Unlimited
Max. no. of join tables	2	255	N/A	Unlimited	250	Unlimited	2	Unlimited
Max. no. of project tables	9	255	N/A	Unlimited	9	Unlimited	2	Unlimited
Max. no. of union tables	2	255	N/A	Unlimited	N/A	Unlimited	2	Unlimited
Max. no. of intersect tables	2	255	N/A	N/A	N/A	Unlimited	2	Unlimited
Max. no. of append tables	1	255	N/A	1	9	Unlimited	2	Unlimited
Max. no. of open data files	10	30	16	10	15	10	Unlimited	100
SORTING								
Permanent	●	○	○	●	●	●	●	●
Temporary (for duration of command)	○	●	○	○	●	●	○	○
Sorts on any field	●	●	○	●	●	●	●	●
Sorts on indexed field only	○	○	●	○	○	○	○	○
Max. no. of fields sorted at once	50	Unlimited	N/A	Unlimited	6	10	16	100

—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable: program does not have this feature.

Parados	R:base for DOS	Omnis Quartz	Tsam-Up	Zim	Advanced Revelation	B.Q.S.S.	filePro 16 Plus	Progress	PC/Focus	pcExpress
$725.00	$725.00	$795.00	$795.00	$880.00	$950.00	$990.00	$990.00	$1,000.00	$1,295.00	$1,495.00
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
(automatic)	(user-defined)	(user-defined)	(automatic)	(user-defined)	(automatic)	(user-defined)	(user-defined)	(user-defined)	(automatic)	(user-defined)
●	●	●	●	●	●	●	●	●	●	●
(autometic)	(automatic)	(user-defined)	(automatic)	(user-defined)	(automatic)	(automatic)	(automatic)	(automatic)	(automatic)	(user-defined)
●	●	●	○	●	●	●	○	●	●	●
(automatic)	(automatic)	(automatic)		(user-defined)	(automatic)	(automatic)		(automatic)	(automatic)	(automatic)
●	○	●	○	●	●	●	○	●	●	●
(automatic)		(automatic)		(user-defined)	(automatic)	(automatic)		(automatic)	(automatic)	(automatic)
●●	●●	●●	●●	●●	○/○	○/○	●●	○/○	○/●	●●
●●	●●	●●	○/○	○/○	●●	○/○	○/○	●○	●/○	○/○
●●	○/○	○/○	○/○	○/○	○/○	○/○	○/○	○○	○/○	○/○
●○	●●	○/○	●●	○/○	●●	●●	●●	●○	●●	○/○
○/○	●●	●●	○/○	○/○	○/○	○/○	○●	○○	○/○	○/○
●●	●●	●●	○/○	●●	●●	○/○	○/○	○○	○/○	●●
●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●
○/○	○/○	○/○	○/○	●●	○/○	○/○	●●	●●	○/○	○/○
●●	●●	●●	●●	●●	●●	●○	●●	●●	●●	●●
○/○	○/○	○/○	○/○	●●	●●	○/○	○/○	○○	●●	●●
○/○	○/○	○/○	○/○	●●	●●	○/○	○/○	○/○	●●	●●
255	Unlimited	120	100	32,000	Unlimited	7	8	1,024	512	Unlimited
255	800	120	N/A	32,000	Unlimited	7	8	10	N/A	Unlimited
●	○	●	○	●	○	○	○	●	○	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	○	●	●	●	●
●	●	●	●	●	●	○	●	●	●	●
●	●	●	●	●	●	○	●	●	●	●
●	●	●	●	●	●	○	●	●	●	●
Unlimited	5	12	N/A	Unlimited	Unlimited	1	N/A	N/A	16	Unlimited
Unlimited	2	12	255	43	Unlimited	1	2	1,023	2	Unlimited
Unlimited	1	60	255	43	Unlimited	1	2	1,023	1	Unlimited
Unlimited	2	Unlimited	255	43	Unlimited	N/A	2	1,023	2	Unlimited
Unlimited	2	Unlimited	255	43	Unlimited	N/A	2	1,023	2	Unlimited
Unlimited	1	2	Unlimited	43	Unlimited	1	2	2	2	N/A
Unlimited	80	60	9	43	6,000	1	20	127	16	Unlimited
●	○	○	○	●	●	●	○	○	○	●
●	●	●	●	●	●	○	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
○	○	○	○	○	○	○	○	○	○	○
255	Unlimited	9	9	32,000	Unlimited	7	8	Unlimited	32	6



If the world had one computer communications

The fact is, today's bewildering variety of computers demands a program like this.

CROSSTALK® Mk.4 is the entirely new generation of PC communications software.

Its language, CASL,™ is designed specifically for the needs of communications and related applications.

- It helps your PC perform a variety of functions with a variety of different devices — direct-connection, modem, coax, or X.PC — up to 15 sessions at a time, if you like.
- It emulates virtually all popular terminals — IBM, DEC, Data General, TeleVideo, ADDS View-

- It supports most popular modems.
- It supports the most widely used file transfer protocols, including XMODEM, YMODEM, KERMIT, CompuServe "B", CROSSTALK, and its own high-speed DART.
- It works with interfaces such as IRMA™ and Smart Alec™ to



standard you wouldn't need Crosstalk Mk.4

facilitate connections with mainframes and minis.

- Its language allows an unprecedented degree of automation of complex applications functions and contingencies.

It does everything you always wished your old communications program could do.

Maybe the world's computers can't be alike. But now at least they can communicate.

See your dealer for CROSSTALK Mk.4, and let your imagination fly.

CROSSTALK Mk.4

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IBM is a registered trademark of International Business Machines Corp. / TeleVideo is a registered trademark of TeleVideo Systems, Inc.
CompuServe is a servicemark of H&R Block / X.PC is a trademark of Tymshare, Inc. CIRCLE 326 ON READER SERVICE CARD

Programmable Databases: Summary of Features

(Products listed in ascending price order)

	1 on 1 = 3!!	VP-Info	VersaForm XL	dBXL Diamond Release	Magic PC	dBMAN	DB-Fabs	Open Access II
SEARCH PARAMETERS	$39.00	$124.95	$159.00	$199.00	$199.00	$249.95	$295.00	$295.00
First occurrences	●	●	●	●	●	●	●	○
All occurrences	●	●	●	●	●	●	●	●
Index field only	○	●	○	○	○	○	○	○
Multiple fields (max. no.)	● (unlimited)	● (60)	● (unlimited)	● (128)	● (unlimited)	● (128)	● (unlimited)	● (15)
Case-sensitive	●	●	○	●	●	●	○	○
Whole word	●	●	○	●	●	○	●	○
Value or character range	●	●	●	●	●	●	●	●
Wildcard or string segment	●	●	●	●	●	●	○	●
Boolean	●	●	●	●	●	●	●	●
Compound Boolean	●	●	●	●	●	●	●	○
QUERY FACILITIES								
Query language	●	●	●	●	○	●	●	●
Proprietary	●	●	●	○	N/A	○	●	○
dBASE III–compatible	●	●	○	●	N/A	●	○	○
SQL-compatible	○	○	○	○	N/A	○	○	●
Other	○	○	○	○	N/A	○	○	○
Query by example	○	●	○	○	○	○	○	●
Query by forms	○	○	●	○	●	○	○	●
Multiple file access	●	●	●	●	●	●	●	●
Query editor support	●	●	●	●	●	●	●	●
Stored queries	●	●	●	●	○	●	●	●
MATHEMATICAL FUNCTIONS								
Date arithmetic	●	●	○	●	●	●	○	●
Time arithmetic	○	●	○	●	●	●	○	○
Arithmetic functions	●	●	○	●	●	●	●	●
Exponential functions	●	●	○	●	●	●	○	●
Trigonometric functions	○	●	○	○	●	●	○	●
Financial functions	○	○	○	○	●	○	○	○
Aggregate functions								
Totals	●	●	●	●	●	●	○	●
Subtotals	●	●	●	●	●	●	○	●
Average	●	●	○	●	●	○	○	●
Count	●	●	○	●	●	○	○	●
Maximum	○	●	○	●	●	○	○	●
Minimum	○	●	○	●	●	○	○	●
STATISTICS								
Standard deviation	○	○	○	●	○	○	○	●
Variance	○	○	○	●	○	○	○	●
COMMAND STRATEGY								
Static menus	●	●	●	●	●	●	●	●
Dynamic menus	●	●	○	●	●	○	●	●
Typed commands	●	●	●	●	○	●	●	●
Supports mouse	○	○	○	●	○	○	○	○
MACROS								
Automatic recording	○	○	○	○	○	○	○	●
Keystroke macro	●	○	○	○	○	○	●	●
Macro language	○	○	○	○	○	●	○	○

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable: program does not have this feature.

**db_Query must be used along with db_Vista.*

DataEdge $395.00	D tha data languaga $395.00	Formula IV $395.00	FoxBase Plus $395.00	Watfile/Plus $395.00	Condor 3 $495.00	Ramis/PC Work-station $495.00	db_Vista III $595.00	Knowl-edge-Man/2 $595.00	NPL/R $595.00	Q-Pro 4 $595.00
○	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
○	●	○	○	○	○	○	○	○	○	●
● (unlimited)	● (unlimited)	● (unlimited)	● (unlimited)	● (unlimited)	● (unlimited)	● (255)	● (unlimited)	● (unlimited)	● (unlimited)	● (128)
○	○	●	●	●	○	●	●	●	●	●
○	●	●	●	●	●	●	●	○	○	○
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	○	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	○	○	●	●	○	●	●	●
○	○	○	●	○	○	○	●	○	○	○
○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
○	○	○	○	●	●	●	○	○	○	○
○	○	○	○	●	○	○	○	●	○	○
○	●	○	○	●	●	●	○	●	●	○

(continues)



Use Premium Fuel Only.

Take ½ gallon of gasoline formulated for high performance motorcars.

Add a clod of dirt, a quart of kerosene, a tablespoon of sugar, and a dollop of axle grease. Sprinkle with rust particles and dog hairs. Stir.

You'd be *crazy* to put *that* in your Ferrari, right?

But what we've just concocted is the petroleum equivalent of a kilowatt of ordinary electricity.

Emerson UPS's Provide Clean Fuel For Computers.

Since today's computers are no less high performance machines than the most sophisticated automobiles, they need highly-refined fuel, too.

Such a simple solution to all the harm spikes, sags, and blackouts can do.

Unrefined Electricity Does Crude Things To Computers.

Unlike bandsaws, washing machines and tv's, computers are hypersensitive to the slightest power variations. Delicate chips can only take so much pounding before they faint dead away. Data can be scrambled or vaporized hardware or software are, in reality, the fault of raw electricity. Industry statistics show that half the downtime, half the staggering costs of lost employee and machine productivity and half the maintenance costs are the direct result of bad electricity.

A typical computer site experiences about 7 blackouts, over 500 sags and more than 2,000 spikes and surges per year. Plus there's almost continuous line noise at even the best locations.

Power surges alone are credited by one insurance company with $35 million in pc losses just last year.

But since computers use only a tiny fraction of the total power output, you



Ditto.

And you can't hold them accountable for kites, birds, acts of God and backwash from motors in your own building.

Any way you look at it, making sure your computer gets premium fuel is up to you. Fortunately, it's easy and affordable.

"UPS" Performance and Throughput

Most people think of Emerson UPS systems as just battery backup protection against power outages.

In reality, they're also the best power *conditioners* money can buy. They work *continuously*, uniquely providing an impenetrable barrier that isolates your computers from power problems.

The result: You get the level of performance your computer was designed to deliver. The level you paid for.

The High Performance UPS Manufacturer.

Emerson makes a full line of power conditioning and distribution systems, even simple surge protectors. And more UPS systems than anybody. One is just right for your large or small, single- or multiple-computer system.



All feature quiet operation, attractive design, UL-listed safety, operation that is one-switch simple, and proven reliability backed by the best service in the business.

So, let us help you rev up your productivity. Simply call 1-800-BACK-UPS for our free introductory brochure and the name of your local representative. Or write Emerson Computer Power, 3300 S. Standard St., Santa Ana, CA 92702.

See us at Comdex, Booth #2820

EMERSON Computer Power

Computers Won't Run Right On The Wrong Fuel.

CIRCLE 157 ON READER SERVICE CARD

Programmable Databases: Summary of Features

(Products listed in ascending price order)

	Quicksilver Diamond Release	DateEase	The O'Hanlon Database Solution	Clipper	DataFlex	dBASE III Plus	The Smart Data Base Manager	PRODAS
SEARCH PARAMETERS	$599.00	$600.00	$650.00	$695.00	$695.00	$695.00	$695.00	$720.00
First occurrences	●	●	●	●	○	●	●	●
All occurrences	●	●	○	●	●	●	●	●
Index field only	○	●	●	○	○	○	○	○
Multiple fields (max. no.)	● (128)	● (255)	● (255)	● (250)	● (6)	● (unlimited)	● (unlimited)	● (100)
Case-sensitive	●	○	●	●	●	●	●	●
Whole word	●	●	●	●	○	●	●	○
Value or character range	●	●	○	●	●	●	●	●
Wildcard or string segment	●	●	○	●	●	●	●	○
Boolean	●	●	○	●	●	●	●	●
Compound Boolean	●	●	○	●	●	●	●	●
QUERY FACILITIES								
Query language	●	●	○	●	○	●	●	●
Proprietary	○	●	N/A	○	N/A	●	●	●
dBASE III–compatible	●	○	N/A	●	N/A	●	○	○
SQL-compatible	○	○	N/A	○	N/A	○	○	○
Other	○	○	N/A	○	N/A	○	○	○
Query by example	○	●	○	●	○	●	○	○
Query by terms	○	●	●	●	●	○	○	○
Multiple file access	●	●	○	●	●	●	●	●
Query editor support	●	●	●	●	●	●	●	●
Stored queries	●	●	●	○	●	●	●	●
MATHEMATICAL FUNCTIONS								
Date arithmetic	●	●	●	●	●	●	●	●
Time arithmetic	●	●	●	●	○	○	●	●
Arithmetic functions	●	●	○	●	●	●	●	●
Exponential functions	●	●	○	●	●	●	●	●
Trigonometric functions	○	●	○	○	●	○	●	●
Financial functions	○	●	○	○	○	○	●	●
Aggregate functions								
Totals	●	●	●	●	●	●	●	●
Subtotals	●	●	●	●	●	●	●	●
Average	●	●	○	●	○	●	●	●
Count	●	●	●	●	○	●	●	●
Maximum	●	●	○	●	○	○	●	●
Minimum	●	●	○	●	○	○	●	●
STATISTICS								
Standard deviation	●	●	○	○	○	○	●	●
Variance	●	●	○	○	○	○	●	●
COMMAND STRATEGY								
Static menus	●	●	●	●	●	●	●	●
Dynamic menus	●	●	●	●	●	●	●	●
Typed commands	●	○	●	●	●	●	●	●
Supports mouse	●	○	●	○	●	●	○	○
MACROS								
Automatic recording	○	○	○	○	○	○	●	○
Keystroke macro	○	○	●	○	○	○	●	○
Macro language	○	○	○	○	●	○	○	●

—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable, program does not have this feature

Paradox $725.00	R:base for OOS $725.00	Omnis Quartz $795 00	Team-Up $795 00	Zim $880.00	Advanced Revelation $950.00	B.O.S.S. $990 00	filePro 16 Plus $990.00	Progress $1,000 00	PC/Focus $1,295 00	pcExpress $1,495.00
●	○	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
□	□	○	○	●	□	●	□	□	□	●
● (255)	● (unlimited)	● (50)	● (100)	● (unlimited)	● (unlimited)	● (95)	● (72)	● (unlimited)	● (255)	● (unlimited)
□	●	●	○	●	●	○	○	□	●	●
□	●	□	●	●	●	□	□	●	●	●
●	●	●	○	●	●	●	●	●	●	●
●	●	●	●	□	●	●	●	●	●	□
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	○	●	●	●
●	●	●	○	●	●	●	●	●	●	●
●	●	●	N/A	●	●	●	N/A	●	●	●
□	●	□	N/A	□	□	□	N/A	□	□	□
□	●	□	N/A	□	□	□	N/A	□	□	□
□	□	□	N/A	□	● (Pick)	□	N/A	□	● (Focus)	□
●	●	□	●	●	□	□	□	□	□	□
●	●	●	□	●	□	●	●	□	●	●
●	●	●	●	●	●	●	□	●	●	●
●	●	□	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	□	□	●	●	□	□	□	□
●	●	●	□	□	●	□	□	□	□	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	□	●	●	●	●	○	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	□	●	●	□	●	●	●	●	●
●	●	○	●	●	○	●	●	●	●	●
●	●	○	○	○	○	○	○	○	●	●
●	●	○	○	●	○	○	○	○	●	○
○	●	○	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
□	●	□	□	●	●	□	●	●	●	●
○	●	●	○	○	○	○	○	○	●	●
●	●	○	○	○	●	○	○	○	○	●
●	●	●	○	○	●	○	□	○	○	□
●	●	●	○	●	○	○	●	○	●	●

(continues)

Miles Apart...



Carbon Copy Plus™, the industry standard in remote control software, can bring you closer. Closer to customers, users, trainees or just about anyone who needs to share a PC application with you.

That's because Carbon Copy Plus remotely operates most DOS compatible programs over regular telephone lines. So now, you can jointly update a spreadsheet with an associate across town or give a new product demonstration to a customer across the country—all without ever leaving your office.

In fact, Carbon Copy Plus is so easy to use and supports so many popular DOS programs that it has applications closer to home. You can run programs located on your office PC while you're on the road or at another facility—without swapping disks or transferring files.

Key into remote training and support

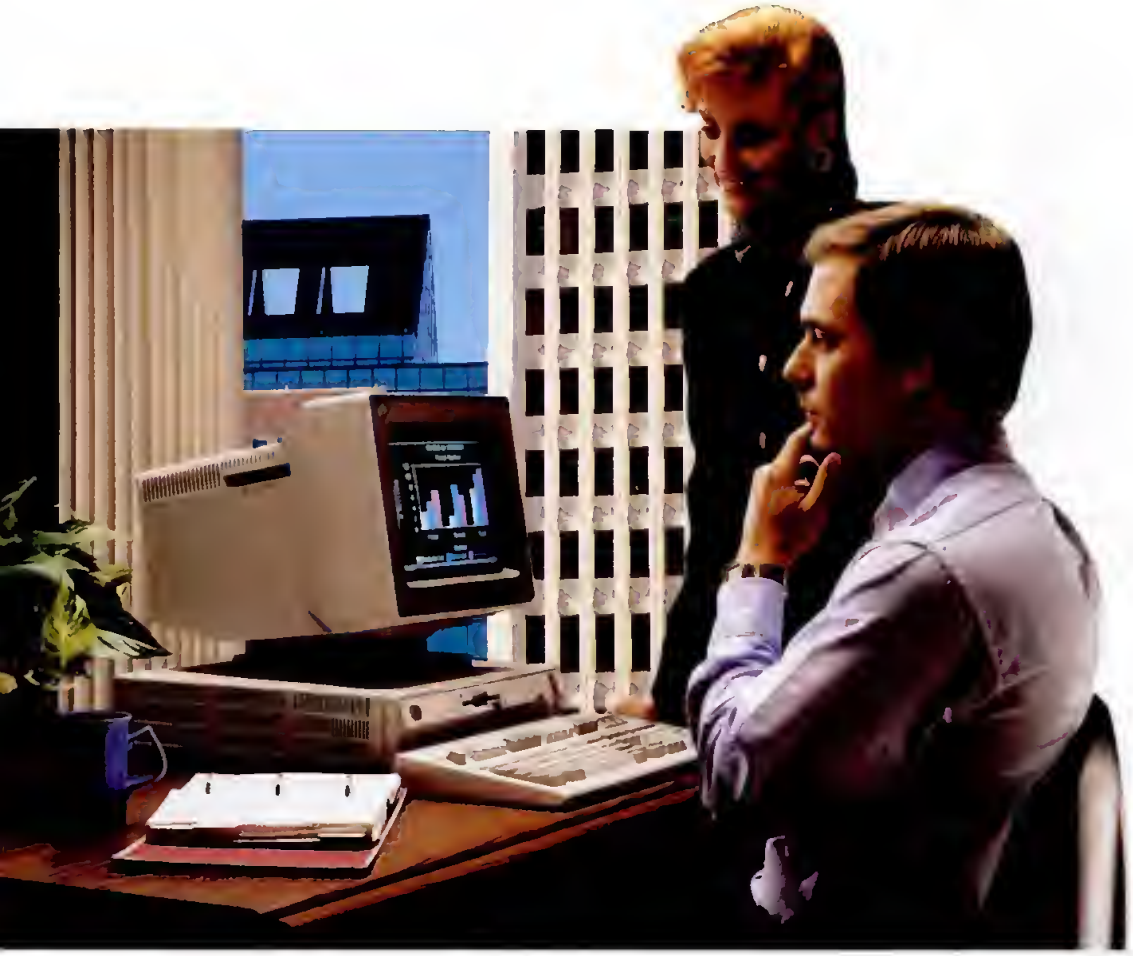
Carbon Copy Plus links two PC users and lets them share screens, keyboards and disks. Whenever a key is pressed on one system, both screens are automatically updated. So now, you can visually demonstrate the effect of each keystroke, in realtime, to users thousands of miles away.

Take advantage of full-fledged communications

Carbon Copy Plus offers other advanced remote communications features, including remote printing, remote access to a local area network and remote

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...But Only A Keystroke Away!



session capture and playback. But it doesn't stop there!

Carbon Copy Plus also offers many of the same features found on "standard" communications programs. You can transfer files using X-Modem or Kermit protocols, emulate DEC®, Televideo® or IBM® 3101 terminals or access minis and mainframes via IRMA™ or SmartAlec™ boards. So when you add file transfer, terminal emulation and complete scripting macros to Carbon Copy's remote capabilities, it just might be the only telecommunications program you'll ever need.

Information in an instant

Find out why Carbon Copy Plus has become the industry standard in remote communications and is fast becoming one of the most popular communications programs overall. Call us today. We'll show you that increasing your productivity and sharing information is only a keystroke away!

Carbon Copy plus

MERIDIAN TECHNOLOGY INC

A SUBSIDIARY OF MICROCOM

7 Corporate Park Suite 1000 Irvine, CA 92714 (714) 261-1199

CIRCLE 228 ON READER SERVICE CARD

Programmable Databases: Summary of Features

(Products listed in ascending price order)

	1 on 1 = 3!!	VP-Info	VersaForm XL	dBXL Diamond Release	Magic PC	dBMAN	DB-Febs	Open Access II
INPUT FACILITIES	$39.00	$124.95	$159.00	$199.00	$199.00	$249.95	$295.00	$295.00
Max. no. of screens per file	Unlimited	Unlimited	1	50	Unlimited	1	2	Unlimited
Max. no. of files per screen	7	6	1	10	Unlimited	10	2	1
Screen definition								
Painting	○	●	●	○	●	○	●	●
Coordinates specification	●	●	○	●	○	●	○	○
Automatic field-name placement	●	●	○	●	○	●	●	●
OUTPUT FACILITIES								
Multiple-file reports	●	●	○	●	●	●	●	●
Page breaks	●	●	●	●	●	●	●	●
Breaks when fields change	●	●	●	●	●	●	●	●
Report definition method								
Painting	○	●	●	○	●	○	●	●
Forms duplication	○	●	●	○	○	●	○	○
Automatic	●	○	●	○	○	○	●	●
Predefined mailing labels	●	○	●	○	○	●	○	○
Programmable	●	●	●	●	○	●	●	●
Stored report definitions	●	●	●	●	●	●	●	●
Line-based	●	●	●	●	●	●	●	●
Form-based	●	●	●	●	●	●	○	●
Output destination								
Printer	●	●	●	●	●	●	●	●
Screen	●	●	●	●	●	●	●	●
Disk	●	●	●	●	●	●	●	●
DOS SUPPORT								
Change default directory	●	○	●	●	●	●	○	○
Access from another directory	●	○	○	●	●	●	○	●
SECURITY								
Passwords for databases	○	○	○	●	○	●	○	●
Passwords for files	○	○	○	●	○	○	○	●
SPECIAL FEATURES								
Applications generator	○	○	○	○	○	○	○	○
Menu generator	●	○	●	○	○	●	○	●
USER SUPPORT								
Cost of telephone support	$1/minute	$5/5 minutes or $50/year (5 hours or 10 calls)	30 days free, then $99/year	$25/call, $50/10 calls, $80/20 calls, $300 unlimited service	$99/year	Free	Free	60 days free, then $125/year
Automatic on-line help	●	○	○	●	●	○	○	●
Tutorial	●	●	●	●	●	●	●	●
Prompt messages	○	●	○	●	●	●	●	●

PC—Indicates Editor's Choice ●—Yes ○—No

DataEdge	D the data language	Formula IV	FoxBase Plus	Wetfile/Plus	Condor 3	Remis/PC Work-station	db_Vista III	Know-ledge-Man/2	NPL/R	Q-Pro 4
$395.00	$395.00	$395.00	$395.00	$395.00	$495.00	$495.00	$595.00	$595 00	$595.00	$595 00
1	Unlimited	Unlimited	1	1	65,534	20	User-defined	Unlimited	Unlimited	Unlimited
1	Unlimited	12	10	1	1	12	User-defined	45	16	255
●	●	●	○	●	●	●	● (programmable)	●	●	●
○	○	●	●	●	○	○	● (programmable)	●	○	●
●	●	●	●	●	●	●	●	●	●	○
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	○	●	●
●	●	●	●	●	●	●	○	●	●	●
○	○	●	○	●	●	○	●	●	●	●
○	○	○	○	●	○	●	○	●	●	○
●	○	●	○	●	●	●	○	●	○	○
●	○	●	●	●	○	●	○	○	○	●
●	●	●	●	●	○	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	○	●	●	●	●
●	●	●	●	●	●	○	○	●	●	○
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	○	○	●	●
●	●	●	●	●	●	●	●	●	●	●
●	○	●	○	○	○	●	○	●	○	○
●	○	○	○	○	○	●	○	●	○	○
●	●	●	●	○	○	●	○	○	●	●
●	●	●	○	○	●	●	○	●	●	●
Free	30 days free, then $100/10 calls, $150/20 calls	90 days free, then $240/year	Free	Free	90 days free, then $10/call or $75/year	Free	60 days free	90 days free, then $400/year	Free	Free
○	○	○	○	●	○	●	○	●	●	○
●	●	●	○	●	●	○	○	●	●	●
○	●	●	●	●	○	●	○	○	●	●

(continues)

How to pick th



Good instincts run in this family (left to right): the new LOGITECH HiREZ Mouse ($179), the only mouse designed expressly for high-res screens; the LOGITECH Series 2 Mouse for the IBM PS/2 ($99, plugs right into mouse port); and the LOGITECH Mouse for standard screens ($119, in bus and serial versions).

All come with Logitech's own Plus Software, which assures ease of use with virtually any software, mouse-based or not.

Though most mice out there look pretty much alike, they're not all equal in performance. It pays to be just a little choosy to make sure you end up with the right mouse for your needs.

Starting with software. If you want full compatibility with all of your software, all you have to do is look for a mouse with the Logitech name. There are four in all, each one designed for different hardware needs.

THE HiREZ MOUSE

If you've got your eyes on a high-resolution screen, the mouse to get your hand on is the new LOGITECH HiREZ Mouse.

With a resolution of 320 dots-per-inch (as compared with 200 dpi or less for ordinary mice), it covers the same area on your high-res screen but needs less of your desk to do it. More than 50% less. Saving you valuable desk space, and effort: mouse maneuvers that used to require sweeps of the hand are now reduced to a flick of the wrist.

Which makes this new mouse a hand's best friend. And a more reliable, long-lasting companion. And, like all Logitech mice, it's fully compatible with all popular software, and equipped with a Lifetime Guarantee.





The LOGITECH HiREZ Mouse needs 50% less desk space to cover the same amount of screen area as a 200 dpi mouse.

THE SERIES 2 MOUSE

For those who've chosen the Personal System/2,™ the most logical choice is the LOGITECH Series 2 Mouse. It's 100% compatible with PS/2, and plugs right into the mouse port, leaving the serial port free to accommodate other peripherals.

e right mouse.



THE ALL-PURPOSE MOUSE: SERIAL OR BUS

Most people find our standard mouse is still the best choice for their systems. It's available in both bus and serial versions, one of which is sure to fit perfectly with your hardware. And with all your favorite software—whether mouse-based or not.

It's hardly an accident that only Logitech offers you such a complete selection—we're the only mouse company to design and manufacture our own products. We make more mice, in fact, than anyone else. Including custom-designed models for OEMs like AT&T, DEC, and Hewlett-Packard.

The three mice pictured to the left come with all this expertise built right in. Which explains an interesting paradox: while you may pay less for a Logitech mouse, you'll surely get more in performance.

A Logitech mouse plus Logitech application software equals a complete solution (all prices include mouse, Plus Software, and application):

LOGICADD...$189. Turns your PC into a full-featured CADD workstation. Everything you need for dimensioned line drawing and CADD.

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And in comfort. With a unique lightweight ergonomic design. Low-angled buttons for maximum comfort and minimum fatigue. An exclusive technology that guarantees a much greater life span. An exceptionally smooth-moving, dirt-resistant roller ball. And natural compatibility with all PCs, look-a-likes, and virtually any software.

All of which leads to an inescapable conclusion: if you want to end up with the right mouse, start with the right mouse company.

Logitech. We've got a mouse for whatever the task at hand.

For the dealer nearest you, call **800-231-7717**

Logitech, Inc., 6505 Kaiser Drive, Fremont, CA 94555.
Logitech Switzerland, European Headquarters,
CH-1111 Romanel/Morges, Switzerland.

Yes! Please send me the name of the nearest Logitech dealer.

Name _____

Company/Title _____

Address _____

Phone _____

LOGITECH

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CIRCLE 133 ON READER SERVICE CARD

Programmable Databases: Summary of Features

(Products listed in ascending price order)

	Quickdriver Diamond Release	DateEase	The O'Hanlon Database Solution	Clipper	DateFlex	dBASE III Plus	The Smart Data Base Manager	PRODAS
INPUT FACILITIES	$599.00	$600.00	$650.00	$695.00	$695.00	$695.00	$695.00	$720.00
Max. no. of screens per file	50	16	1	Unlimited	255	1	9	Unlimited
Max. no. of files per screen	10	255	16	Unlimited	9	10	15	1,600
Screen definition								
Painting	○	●	●	○	●	●	●	○
Coordinates specification	●	○	○	●	○	●	○	●
Automatic field-name placement	○	○	●	○	○	●	●	○
OUTPUT FACILITIES								
Multiple-file reports	●	●	●	●	●	●	●	●
Page breaks	●	●	●	●	●	●	●	●
Breaks when fields change	●	●	●	●	●	●	●	●
Report definition method								
Painting	○	●	●	○	●	○	●	○
Forms duplication	○	●	○	○	○	○	●	○
Automatic	○	●	○	○	●	○	●	●
Predefined mailing labels	○	●	○	●	○	●	●	○
Programmable	●	●	●	●	●	●	●	●
Stored report definitions	●	●	○	●	●	●	●	●
Line-based	●	●	●	●	●	●	●	●
Form-based	●	●	●	●	●	●	●	○
Output destination								
Printer	●	●	●	●	●	●	●	●
Screen	●	●	●	●	●	●	●	●
Disk	●	●	●	●	●	●	●	●
DOS SUPPORT								
Change default directory	●	●	●	●	●	●	●	●
Access from another directory	●	●	●	●	●	●	●	●
SECURITY								
Passwords for databases	●	●	●	○	○	●	●	○
Passwords for files	●	●	○	○	○	●	●	○
SPECIAL FEATURES								
Applications generator	○	●	●	○	●	●	●	○
Menu generator	○	●	●	●	●	●	●	●
USER SUPPORT								
Cost of telephone support	$25/call, $50/10 calls, $80/20 calls, $300 unlimited	Free	2 hours free, $60/hour thereafter	$99/year	Free; premium support, $400/year	90 days free, then $50–$150/year	Free	Free
Automatic on-line help	○	●	○	○	○	○	●	○
Tutorial	○	●	●	○	●	●	●	●
Prompt messages	●	●	●	●	●	●	●	●

PC—Indicates Editor's Choice ●—Yes ○—No

Paradox	R:basa for OOS	Omnis Quartz	Team-Up	Zim	Advanced Revelation	B.O.S.S.	filePro 16 Plus	Prograaa	PC/Focus	pcExpress
$725 00	$725.00	$795 00	$795.00	$880 00	$950.00	$990.00	$990.00	$1,000.00	$1,295.00	$1,495 00
15	Unlimited	Unlimited	255	32,000	Unlimited	1	Unlimited	Unlimited	1,280	Unlimited
Unlimited	5	12	255	32,000	Unlimited	1	1	127	16	Unlimited
●	●	●	●	●	●	○	●	○	●	●
●	○	○	○	●	○	●	○	●	●	○
●	●	○	○	●	●	●	●	●	●	●
○	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	○	●	●	●	●	●	●
●	●	●	●	○	●	○	●	○	●	○
●	●	○	○	●	○	●	●	○	●	●
○	●	●	○	○	●	●	○	○	○	○
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	○	●	●	●	●	●	●	●
●	●	●	●	●	●	○	○	○	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	○	●	●	●
●	●	○	●	●	●	●	○	●	●	●
●	●	●	●	●	●	●	●	●	●	○
●	●	○	●	●	●	○	●	○	●	●
●	●	●	●	○	●	●	●	○	●	●
Free	Free; premium support, $175	60 days free, then $95/year	30 days free, then $15/call or $250/year	Free, premium support, $200	$200/year	30 days free, then $60/hour $15 minimum	$175/year	15% of list price	90 days free; negotiable thereafter	$250/year
○	●	○	○	●	●	○	○	○	○	●
●	●	●	●	●	●	●	●	●	●	●
●	●	●	○	●	●	●	●	●	●	●

he really means *dBASE*, the stuff that comes in an Ashton-Tate box, or if he means one of the *dBASE* alternatives, such as *Clipper* or *Quicksilver*. Many individuals, corporate users, and systems developers have forsaken the Ashton-Tate product, opting instead for the speed, ease of use, and economy of third-party alternatives.

Just what constitutes the true *dBASE* language has also become a matter of debate. Ashton-Tate argues, with some justice, that since *dBASE* was its invention, its product, "*dBASE*" is exactly what Ashton-Tate says it is, no more and no less.

Meanwhile, a committee of third-party vendors of *dBASE* add-ons and *dBASE* replacements has been working on a common definition of the language. Since many of their products stretch and tweak and add little bits here and there to Ashton-Tate's original, the idea of a *dBASE* "standard" has fallen by the wayside. Invited to join these third-party developers in a broad redefinition of just what constitutes a standard *dBASE*, Ashton-Tate has declined.

Recently, Ed Esber, Ashton-Tate's CEO, confronted *dBASE* cloners with a "Make my day!" challenge worthy of Dirty Harry himself—in the process bringing about an impasse in standard-setting efforts.

No doubt part of Esber's approach has grown out of concern that too much attention to the dClones would steal some of the thunder from the introduction of the long-awaited *dBASE IV*. Just now appearing, *dBASE IV* shores up nearly every weak area of *dBASE III Plus*, while adding functions that programmers and users of *dBASE* have been clamoring to see for years. (See First Looks, page 33, in this issue.)

The Assistant screen has been replaced by a "Control Center," which allows access to all parts of the program. While the infamous dot prompt remains for those accustomed to earlier versions' command-line mode, users can now hit F10, then make menu picks. If *dBASE* falls short of IBM's new SAA standards by not allowing direct Alt–letter-key menu choices, it comes closer than ever before—and demonstrates a new sensitivity at Ashton-Tate to the importance of friendly user interfaces, even in "power-user" products.

dBASE IV also, finally, includes a compiler, with execution speeds of the resulting .EXE files besting those of *Clipper* and *FoxBase*.

OTHER VOICES While Ashton-Tate was building a huge market share for *dBASE* and enjoying the thoroughly mixed blessing of watching other companies extend and improve its product—in the process, of course, siphoning off sales—other high-end, programmable database programs went in other directions.

■ An astonishing amount of the database power once available only on minis has migrated to PCs.

Recognizing that unsophisticated users need all the help they can get writing program code—and even the savviest professional developer likes to save time and effort when possible—some programs have added more and better applications-generation (or "app-gen") development tools.

Microrim, for example, has steadily expanded the range and sophistication of application-building tools provided with its program, *R:base*. The Application Express module in current versions can handle virtually every step involved in creating simple to moderately complicated jobs—and by writing some if not all of the necessary code, can give users a head start on the tricky jobs.

DataFlex, the industrial-strength DBMS from Data Access Corp., also offers superior app-gen tools. Data Access listened to users' tales of woe about the time spent building input screens, then developed a system that lets users simply type in their screen layouts (or "paint the input screens," if you like to sling around big-time database lingo) with any word processor or plain-ASCII editor. *DataFlex* runs these "images" through its Auto-Create module and the job is done.

Borland's *Paradox* has from the beginning had a superior programming language, PAL (Paradox Applications Language), and now is pushing *R:base* and others with helpful app-gen tools.

Paradox has also incorporated the most civilized approach to network use of a DBMS, by offering automatic updating of the screens of all users examining a *Paradox* record. Other programs show how things *were* in the database; only *Paradox* shows how they *are*, with automatic updates every 3 seconds—or another interval, as the user specifies.

DataEase, which has for years been one of the sleepers in the PC DBMS business, offering gorgeous screens, excellent quick-report writing, fast operation, superb ease of use, and very good data security provisions, has now gone after the connectivity market with *DataEase Connect*. It links to mainframe databases through *Answer/DB*, to let PC users work with mainframe data in what looks to them exactly like familiar old *DataEase*. Queries are processed and sent to the mainframe; data is returned in a form directly manipulable by *DataEase*.

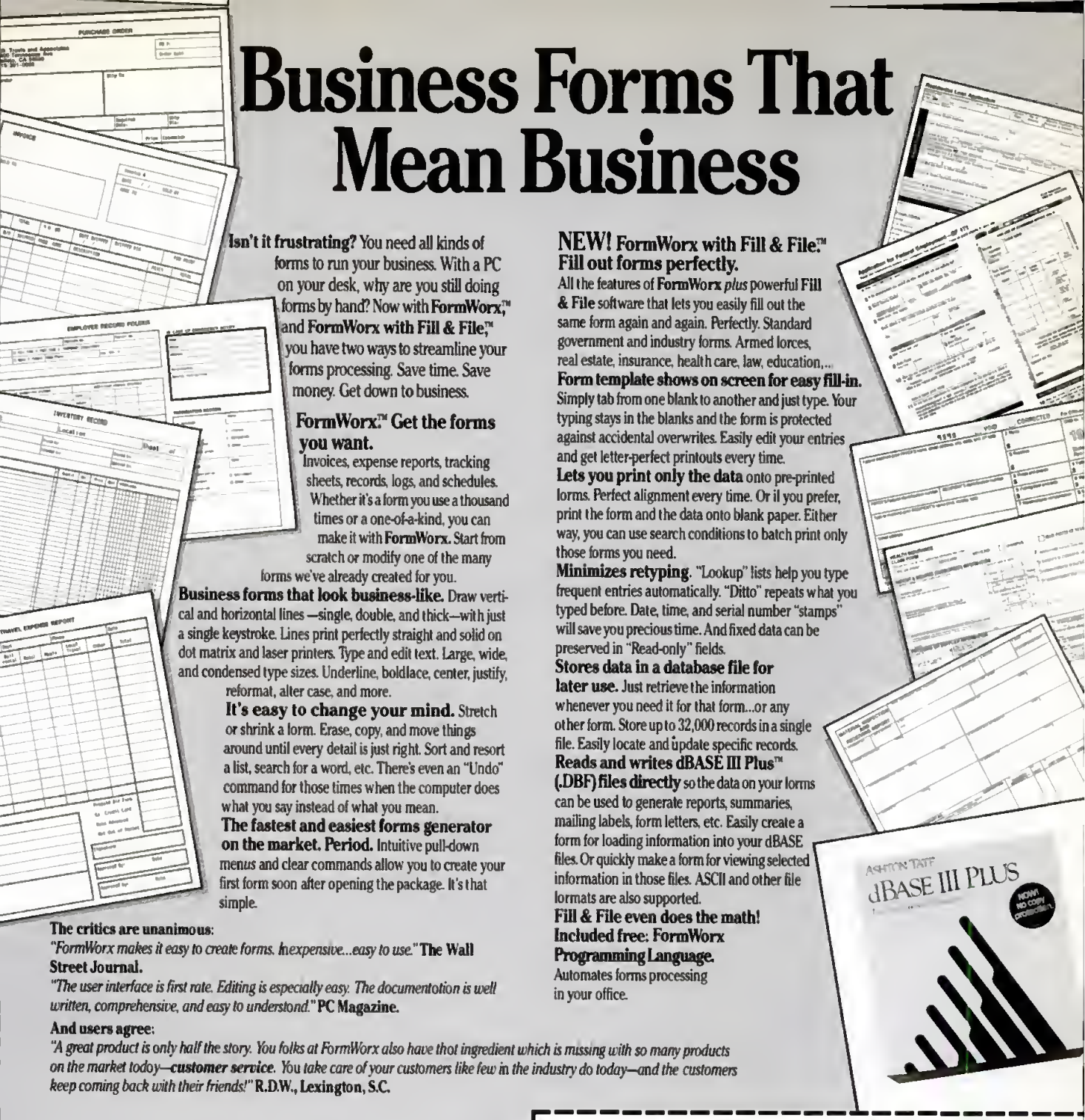
PRIMARY TOOLS Databases lie at the core of most businesses' use of computers. From accounting systems generating predefined reports (which we call by names such as *invoices*, *payroll checks*, and *balance sheets*) to systems built on customer lists, inventories, and a dozen other critical elements, businesses run on their databases.

Programmable relational database products are the foundation on which the great majority of those business systems are built. In less than 7 years since the first IBM PC was introduced (August 1981), an astonishing amount of the database power once available only on minicomputers has migrated to the PC.

Owners of small businesses can now have the kind of timely, accurate information they need to manage their businesses well—the kind of information once available only to megacorporations with glass houses full of mainframes and corps of COBOL and DB2 and NOMAD and Focus programmers.

And PC-savvy employees of those megacorporations can themselves use these superb tools, building for use on their

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Hardware requirements: Over 125 printers supported. Requires IBM PC, PS/2, or compatible with DOS 2.0 or higher. FormWorx—320 KB. FormWorx with Fill & File—512 KB. Works with or without a graphics board. Color is displayed on color systems. Available on 3.5" disks when specified. Not copy protected.

Prices and terms subject to change without notice. Trade-up rebate offer expires June 30, 1988. FormWorx and Fill & File are trademarks of FormWorx Corporation. dBase III Plus is a trademark of Ashton-Tate.

CIRCLE 174 ON READER SERVICE CARD

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own desks and in their own departments systems with immediate value and fast paybacks. No longer must they become supplicants to the MIS/DP priests and suffer through their infamous 18-to-24-month new-applications backlog. And those mainframe programmers will be left to find new meaning in Do While loops, as they wonder about their futures and watch database power ebb away from the Big Iron they tend.—**Jim Seymour**

Jim Seymour is a contributing editor of PC Magazine.

Advanced Revelation

Advanced Revelation, in its initial Version 1.0 release, is a powerhouse of a product and should have a significant impact on the high-end DBMS scene. Priced at $950, it packs all the power and functionality of the original *Revelation* product (at release level "G2B") and makes major strides into some areas that were not well supported—or supported at all—by the earlier package.

This is no evolutionary release from Revelation Technologies. *Advanced Revelation* is totally new and bears all the earmarks of newness: I found serious problems in installing the software, some inconsistencies in operation that would confuse a *Revelation* novice, and quite a few conditions that would either abort a process abruptly or drop me right out of the system and back to a DOS prompt. Lack of robustness is common in new products, and *Advanced Revelation* is no exception. Nonetheless, its design, structure, and added features make this latest offering an attractive alternative to the more-traditional relational DBMS products.

The original software I received should never have gotten through the vendor's quality control department: it would not install. *Advanced Revelation* comes on seven 360K floppy disks, and the installation procedure died after the sixth one, locking the keyboard and leaving 110 "lost clusters" on my hard drive. Neither I nor the vendor's tech support could unlock the problem, and I had to get another copy of the software before proceeding with the testing.

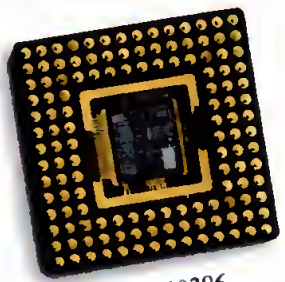
The disks arrive in a documentation box that takes two hands to lift. Inside you will find seven manuals, including a 68-page "Quick Reference" booklet. The material is meticulously indexed and cross-referenced, and I found it to be exceptionally complete and accurate, particularly for an initial product release.

Logging into the *Advanced Revelation* system is simple. What you see on your screen, however, is rather complex. On

OUR REVIEWERS

Michael Alesandro is a partner with Advantage Business Systems, a New York–based consulting firm. He specializes in the design of custom database systems operating on local area networks.
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Victor E. Wright is a mechanical engineer in Louisville, Kentucky, and a contributor to various computer and engineering trade magazines.

This chip is too smart to be in a personal computer.



The Intel 80386 microprocessor

Introducing the corporate 386.

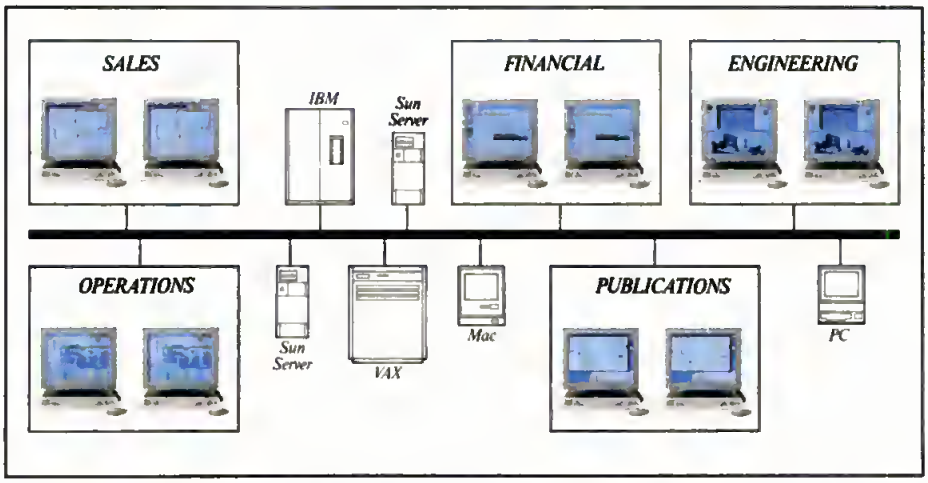


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But, in most corporations, the real work is done by many people, all trying to work together. Computers should aid this process, by giving individuals the personal power they need, and by helping groups of people work together productively.

Different groups need to share and work with the same information, even though they may be using different computers, or their data is kept on remote mainframes.



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So they can't handle the really demanding applications. And they only talk to themselves, with some difficulty, rather than to all of your computers.

That's why we're introducing the corporate 386. The Sun386*i*™ workstation. It has the same high-performance Intel® 80386 chip as the PCs.

But not their personal limitations.

Because it runs Sun's open, distributed computing environment, built around the UNIX® operating system.

So, you have transparent access to every computer in your company. No matter which vendor's name is on the box.

Unlike the PCs, the Sun386*i* lets you take full advantage of the thousands of powerful applications designed around the UNIX operating system. But it also lets you run all of the PC DOS applications that millions of users have developed so much expertise in.

And with its 5-MIPS power, UNIX and DOS applications can run simultaneously and at full speed.

But with all this power and sophistication, isn't a Sun386*i* harder to use than a PC?

Not at all. In fact, it's easier.

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This system is not designed for the novice, nor will it be a comfortable vehicle for the product developer who wants to build systems that match the look and feel of an existing product line. *Advanced Revelation*–based systems are expected to look like *Advanced Revelation*, and the built-in user interface is hard to disguise. This will be a particular concern for those organizations currently marketing software products written under the *Revelation* operating system, since the new *Advanced Revelation* product does not lie on an upward-compatible migration path. You can "import" the majority of your existing software into the new *Advanced Revelation* environment, but it isn't the same when you do.

Different types of users will have markedly different reactions to *Advanced Revelation*. A power user accustomed to *Revelation*, and starting from scratch to design something new, will find *Advanced Revelation* a pleasure to work with. That's due in part to the tremendous facility of the software. It's also because the system provides a flow model for the generated screens, menus, and reports.

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For example: The import function is easy to use but produced very disappointing timings. At a throughput rate of 53 records per minute, it took over 1½ hours to import the 5K test database and over 15 hours to bring in the 50K file. I wrote a small program in R/Basic (*Revelation*'s proprietary language) to generate the 50K file directly, and it ran to completion in 3 hours and 7 minutes. The simple formatting required for the test database (delimited ASCII input) can hardly account for the other 12 hours of time.

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Revelation Technologies Inc.
3633 136th Pl. SE
Bellevue, WA 98006
(206) 643-9898
List Price: $950
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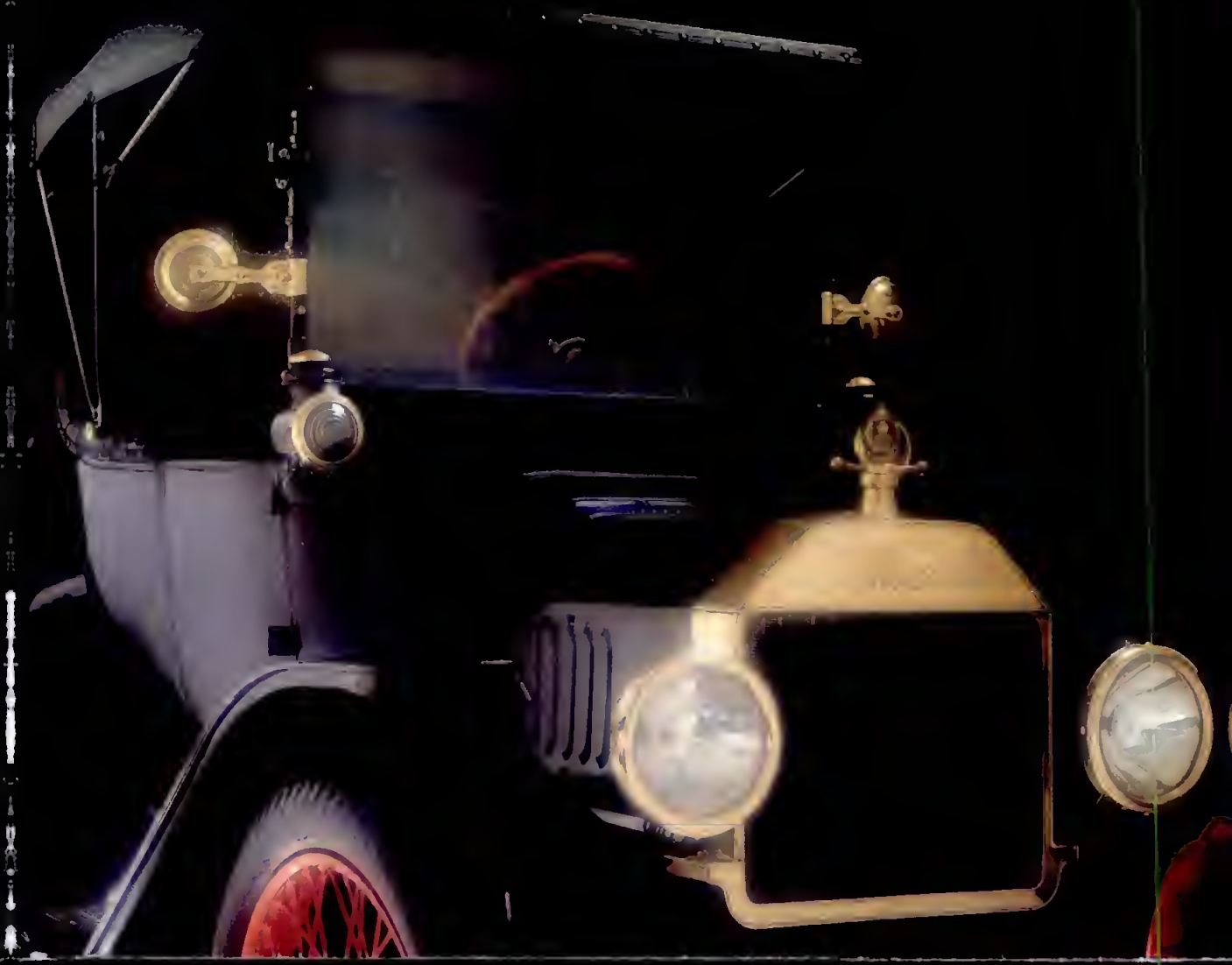
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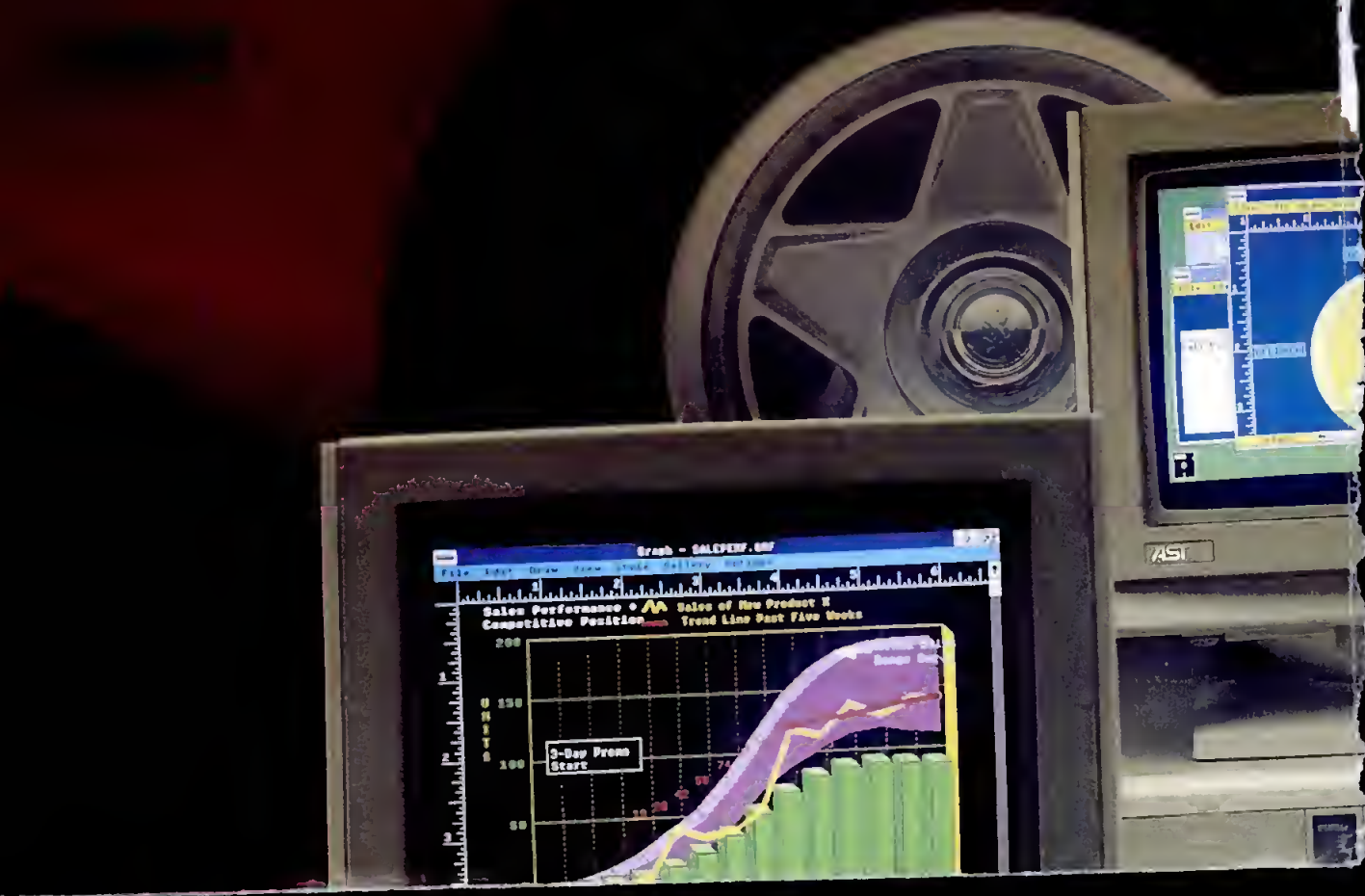
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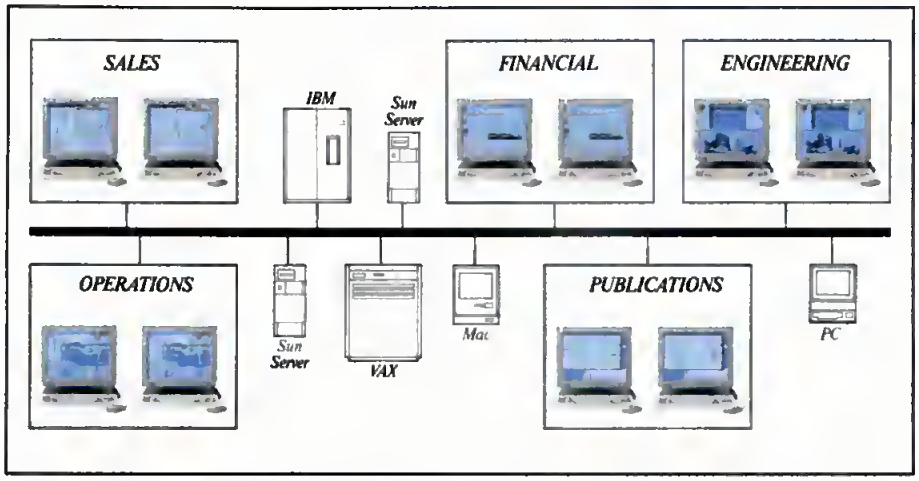
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2. Insert this sheet with
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simply create a subdirectory and copy the three program disks provided with the package, then the menu comes up.

The *B.O.S.S.* menu allows you to run the Execution system, the Development system, Utilities, or DOS commands, or exit the package. Menus are shown in windows, and you can make a selection by typing the first letter of the command or by using cursor keys. Pressing Return selects the menu choice. Subsequent menus that appear are laid on top of each other, and you can return to the previous menu by using the Esc key.

Learning to use *B.O.S.S.*'s data entry screens will probably take you a little time. You move from field to field by pressing Return until you strike F1 to save the data. Unlike most applications, this program is set up so that help messages appear when you press F10. The cursor keys will move you to different fields, and the function keys perform such duties as deleting a record, reading the next record, and copying from the last record. The Esc key always lets you exit from the current screen.

FILE DEFINITION You must start with the Development system to create data files, and APC assumes that you have a working knowledge of MegaBasic before you can use it. First, you create a dataset description that defines the fields in the database. Fields can be alphabetical (left- or right-justified), numeric, date, or Boolean, and they can include up to 255 characters. You specify a six-character field name, a screen prompt, and an offset that can be used to position the prompt on the screen.

Using other entry screens, you can define the indexes for the file, create range and table verification parameters for each field, and print lists of the definitions. You must then tell *B.O.S.S.* to write the definition to the disk. Next, you create the file with another menu choice, indicating its approximate size.

B.O.S.S.'s Execution system is designed to be used by end users. It includes what APC calls Level I (simple) data entry and reporting. The data entry program asks for the filename and creates a simple screen based on the information in the file definition. You then add records, one per screen, and again store them by pressing F1. A different program allows you to recall these records for editing, listing them in a more reportlike format. You select the line number to edit, and *B.O.S.S.* cycles through the fields until you type F1. Pressing Esc returns you to the menu.

CUSTOMIZED REPORTS *B.O.S.S.*'s report writer is simple yet offers numerous options to help you create the report you need. You can only report on a single file, but you can use any of the indexes that were set up in the file definition or you can create your own ad hoc sort on up to eight fields. You can include or exclude any fields from the report, and you can limit your selection to ranges of information. Column headings come from the file definition, and you can send the report to the screen, the printer, or a spooled file on the disk.

The Execution system also allows you to import and export comma-delimited, fixed-length, mail-merge, and some special BASIC file formats. *B.O.S.S.* can verify data as it is loaded and skip bad records. In addition, you can execute Level II (complicated) inquiry and report programs created in the Development system.

Once you've mastered the Execution system, you can return to the Development system to create customized inquiry and report programs for end users. In addition, you can specify computed fields and define the records that are to be skipped. To do this, though, requires the skills of an experienced programmer; the definitions are indeed tricky to use.

As you might expect of a package designed for applications developers, *B.O.S.S.* has some nice tools for programmers. For example, you can create help texts with your own word processor and compile them with *B.O.S.S.*'s help text generator. Then when you are using an application program, pressing the F10 key will cause *B.O.S.S.* to search the help file and match on database name, filename, or menu choice. You can also create menu definitions that *B.O.S.S.* will use as a front end to your application.

■ It is obvious as you become familiar with *B.O.S.S.* that you need to know MegaBasic to use the package effectively.

SPEAK THE LANGUAGE It is obvious as you become more familiar with *B.O.S.S.*'s tools that you need to know MegaBasic to use the package effectively; without fluency in MegaBasic, you'll find the package fairly limited. For example, for times when menu choices are disabled or "system errors" occur, you need to know MegaBasic to recover from them. For applications programmers, MegaBasic offers a number of nice features, including multiple workspaces, an assembly language interface, and enhancements to BASIC.

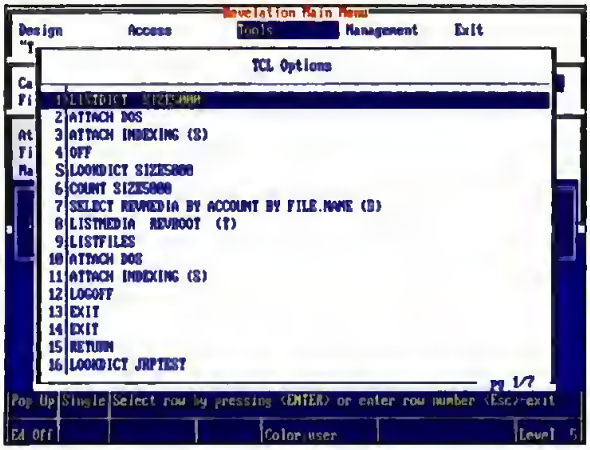
The manuals that come with *B.O.S.S.* are somewhat limited and hard to use. They have neither indexes nor instructions on the use of Level II reports and inquiries, and many of the screens go unexplained. The end user manual is little more than a tutorial, although the developers' reference guide is adequate and includes some lengthy discussions on creating help text

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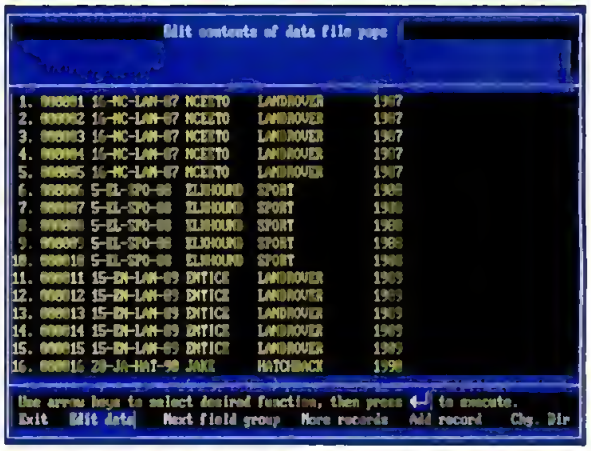


***B.O.S.S.*, Version 9.31**
American Planning Corp
P O Box 9635
Alexandria, VA 22304
(800) 368-2248
(703) 751-2574
List Price: Single-user version, $990; multiuser version, $1,895; with day-long training session, $1,495
Requires: 640K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: Designed for applications developers rather than end users, *B.O.S.S.* affords programmers general data entry, editing, inquiry, and reporting capabilities. A thorough knowledge of MegaBasic is required to push this package to its limit. Not copy protected.

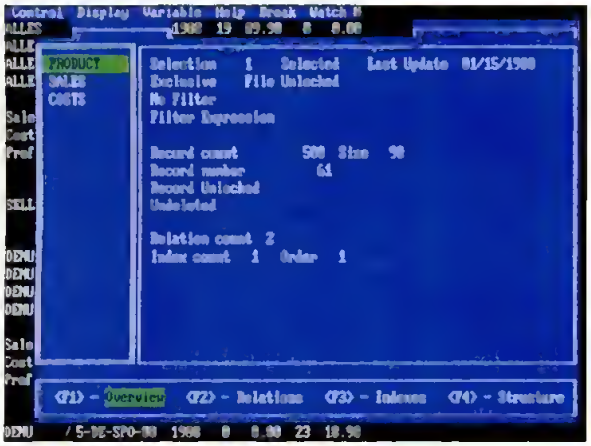
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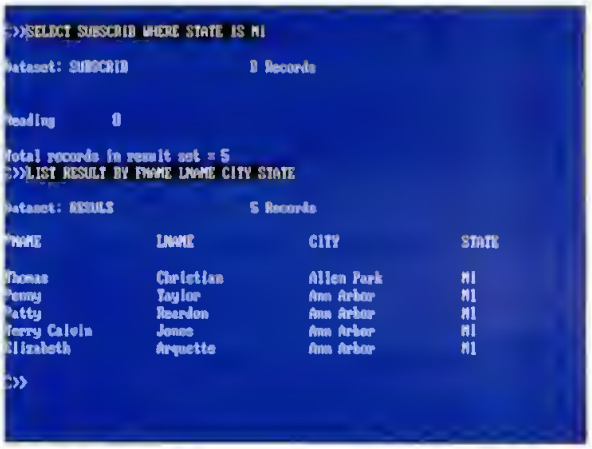
Advanced Revelation *stacks all your executed commands, letting you recall them with a keystroke. The stack is held from session to session, and its maximum length can be set for each user.*



For editing data, **B.O.S.S.** *lists up to 16 records on the screen, from which you select the line to change. Data that does not fit on the screen can be displayed by selecting Next Field Group.*



Clipper'*s debugger can be linked to an application and invoked at any time. Menu driven and interactive, it can be used to view the status of variables or files and step through programs line by line, or to specify breakpoints at predefined positions.*



Condor 3 *allows you to extract a portion of your database and store it in a Result dataset using the Select command. You can then execute most of the commands on the Result dataset without modifying the main database.*

and menus, as well as on using MegaBasic functions. The MegaBasic manual is quite complete and detailed—which is fortunate, considering that you have to be well versed in the language to exploit the package's power.

Don't try *B.O.S.S.* unless you want to build an application and you're familiar with MegaBasic. It has some nifty features for programmers, but it is also a difficult package for end users to master. Leave this one to the programmers.—**Mike Falkner**

Clipper

Nantucket Corp.'s $695 *Clipper*—in the version identified simply as Summer '87—is first and foremost a development tool for creating and compiling programs and applications. Its database files and programming language are *dBASE III Plus* compatible, with very few exceptions. While you won't find the familiar *dBASE* dot prompt or Assist mode, that's appropriate: *Clipper* is neither menu driven nor designed for nonprogrammers.

Clipper does have several enhancements to the *dBASE* language that greatly improve its performance. It can save entire screens to memory variables and restore them instantly; set up to eight concurrent relations among files; declare one-dimensional arrays, each occupying a single memory variable slot; and compile and run existing *dBASE* applications, often without modification.

But few people buy *Clipper* because of its improvements on the *dBASE* language.



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They buy it for its most noticeable asset, the blazing execution speed of a compiled language.

And because *Clipper* is a compiler, you can run a *Clipper*-compiled *dBASE* application without needing either the *Clipper* program or the *dBASE* source code. For further flexibility, Nantucket offers unlimited run-time distribution rights to all *Clipper* developers.

The *Clipper*, Summer '87, manual makes the Autumn '86 documentation look like a quick-reference card. In addition to covering *Clipper*'s commands and functions, the manual has sections on the *Clipper* Debugger, using *Clipper* on a LAN, and the various utility programs supplied with *Clipper*, such as RL.EXE and DBU.EXE. The RL.EXE program allows you to create and modify *dBASE*-compatible report and label form files; DBU.EXE lets you create, modify, view, and index database files interactively without writing procedures. Both utilities improve on Autumn '86's Create, Report, and Label utilities.

Clipper index files (.NTX) are not compatible with *dBASE*'s (.NDX), but they're much faster. If your application requires *dBASE*-compatible index files, a new utility lets you create and maintain them within *Clipper*.

Clipper's new debugger is menu driven, interactive, and even user-friendly. It helps you locate those hard-to-find program errors during run time by stepping through program execution line by line, or by setting breakpoints anywhere within the code. You can also check the status of just about any element of the system by viewing the file structures, file relations, index key expressions, and public or private memory variables.

For applications that require context-sensitive help, *Clipper* lets you set up a customized HELP.PRG procedure file accessed by F1. Parameters that save the current code position and describe which help message to access are passed to the HELP.PRG file.

NEW AND IMPROVED *Clipper*, Summer '87, has many new and improved commands and functions. Among them are an array function for creating light-bar menus, one for sorting array elements, and one for designating a portion of the screen to be scrolled up or down—or cleared. Also included is low-level access to DOS files and devices.

Nantucket takes the problem of memory management seriously and provides a viable solution to this enemy of applications developers. When linking applications, *Clipper* uses an automatic allocation technique to assign memory to different parts of an application. If expanded memory exists, *Clipper* automatically detects it and uses up to 1MB for index buffers, greatly increasing index speed.

Two features of *Clipper* that most serious applications developers can't live without are user-defined functions (UDFs) and the ability to use functions written in other languages like C and assembler. UDFs are customized functions used for such things as validating data entry in @..GET statements or serving as field descriptions in reports.

Clipper allows programmers to write UDFs using either the *dBASE* language, Microsoft C (or a compatible C programming language), or assembly language. *Clipper*'s Extend System allows programmers to access the open architecture of the *Clipper* programming language through low-level language calls, making often-used functions execute much faster. And unlike the sluggish and memory-hungry Call command, the Extend System tells *Clipper* to treat the C or assembler functions as if they were internal functions.

MODIFYING YOUR STRATEGIES If you're a programmer accustomed to developing applications using interpreted languages, you'll have to modify your strategy when using a compiled language (unless you have a copy of *dBASE*). The development stage is no longer interactive in *Clipper* alone, but many *Clipper* programmers develop applications using interactive *dBASE*, then compile them and add *Clipper* enhancements later. *Clipper*'s debugger also helps in the development phase of applications.

Although many *dBASE* applications can be compiled and run under *Clipper* with little or no alteration, some incompatible commands (including Set Carry, Return to Master, Edit, and Browse) can lead to unnecessary headaches. Programmers can usually develop workarounds for these types of commands, but one of them can get you into trouble.

In network programming, most networking errors are trapped with the On Error command. But this command results in an error when encountered by *Clipper*. Portions of code that use the command must therefore be rewritten.

Clipper, Summer '87, offers many advanced programming features that help extend the boundaries of PC applications. The utility programs, user-defined functions, advanced memory management, menu-driven debugger, and the programming language's open architecture make *Clipper* an extremely powerful developers' tool. Surprisingly, you can have all this functionality with a remarkable amount of speed, too.—**Greg Alwang**

PC MAGAZINE FACT FILE



***Clipper*, Summer '87**
Nantucket Corp
12555 W. Jefferson Blvd., #300
Los Angeles, CA 90066
(213) 390-7923
List Price: $695
Requires: 256K RAM, two disk drives (hard disk recommended), DOS 2.0 or later
In Short: A *dBASE* compiler with advanced programming features and an open architecture allowing direct use of functions written in C or assembler. Powerful utility programs and blazing speed make this program a front-runner among *dBASE* compilers. Not copy protected.

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Condor 3

Condor Computer Corp.'s relational databases have been the standard for many government operations over the years. Of late, Condor—in its 11th year as a software company—has been trying to attract other groups of users. With *Condor 3* ($495), which sports a new manual and promises faster performance, the company has a good chance of succeeding.

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tory and copy it to your hard disk. The user manual contains a very detailed and clear tutorial that brings you up to speed quickly. In addition, Condor provides a disk with numerous example files to help you learn the system.

You can control *Condor 3* through either a menu system or English-like commands that you enter at a "C>>" prompt. The 35-plus commands are patterned after SQL and include a verb, the dataset name, optional modifiers, and optional field names. For example, LIST PARTS WHERE QTY GT 10 BY PART-ID DESC QTY opens the database called PARTS and lists the I.D., description, and quantity for items with more than ten in stock. *Condor 3*'s programming language, which uses a simple if-then approach, is more limited than its command set.

You can also use *Condor 3*'s menu system to help you find the commands you need. The first screen lists seven categories of commands; a second screen lists the commands themselves. When you select a command, *Condor 3* displays a screen with a description of the command, the proper syntax, and the first word typed in. You still have to complete the command, but at least you've got some help.

DATABASE CREATION Creating a *Condor 3* database is a two-step process. After entering the Define command, you receive a blank screen for defining data entry requirements. Field names are surrounded by the characters [and], and field widths are defined by the number of underlines following the names. You can place them anywhere on the screen along with plain text to dress up the screen. The End key ends the screen definition, and *Condor 3* then asks for field types (alpha, alphanumeric, numeric, date, or currency), the minimum and maximum values, and a default value for the field.

You can add and change information with the Enter and Update functions. You enter data using the cursor keys to move you between fields. *Condor 3* has a fill feature that automatically loads the default field value into a field, and a repeat feature that copies values from the previous record into the current screen. A menu at the bottom of the screen prompts you to save, cancel, and delete records.

Condor 3 has two functions that globally change the database. The Change command changes text fields from one value to another, and you can limit those changes to certain conditions. For numeric field changes and calculations, you need to use the Compute command.

Once you've cleaned up the data, there are several ways to view it. The List command can show one record at a time or create a column from the fields you specify. The Display command searches for records matching your criteria, displays the first record, and provides options at the bottom of the screen for moving through the data. In addition, with the Printer command, you can reroute reports to the screen, disk, or printer.

When you don't need every record, you can use the Select command to extract information into a temporary file based on the limits you specify. All *Condor 3* commands work on this file, and you can use it for creating ad hoc reports, temporary analyses, and sorts that you don't want to save. In addition, you can use the Project command to create new databases with only a few fields, the Join command to merge two databases with different fields, or the Append command to add records from one database to another.

REPORT CREATION *Condor 3*'s report writer has a lot of capability although it is a little cumbersome to use. To create a report, you first paint a screen with the headings, field definitions, calculations, subtotals, and totals. Next you are asked to describe the layout (headers, subtotals, wheather to print on every line) and define print positions, format, and any sort breaks. You can use either the short method, which makes some assumptions about the line spacing, or the long method, which requires that you specify your requirements. Although the prompts are fairly clear, the report writer is not very forgiving if you make a mistake. Correcting errors can be a tedious process.

For repetitive tasks, *Condor 3* has a command processor to handle batch-oriented work. You can create a command file by letting *Condor 3* capture keystrokes or by using your own editor. In addition to *Condor 3* commands, you can send messages to the screen, halt the process and request information, perform if-then tests, and store variables for testing later in the command processor.

EXTRAS AND IRRITATIONS Besides the usual commands, *Condor 3* has a few special features. The Tabulate command summarizes sorted fields and displays one line per unique item. The Stats command totals a field and displays its minimum, maximum, and average values. The Help command loads menus, created by users, that can execute *Condor 3* commands. For importing and exporting, Condor 3 uses Read and Write commands to handle fixed-length and variable-length formats, including comma-separated, RPG, and other formats.

The documentation for *Condor 3* is excellent. The tutorial section is well organized, letting you quickly learn how to use the package. The reference section is alphabetized, and the commands are described in detail with lots of examples. The report writer tutorial and reference sections, as well as the glossary and error-message section, follow suit and are easy to use. Condor sends its users a newsletter with helpful hints, and it also offers books and seminars on the use of its package.

Although the package is pretty solid, it does have a few limitations. Most of the *Condor* commands work on only one file, so you must Join related files before you can report on them. The routines for defining screens, files, and reports work proper-

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***Condor 3*, Version 2.20a**
Condor Computer Corp.
1490 Eisenhower Pl.
Ann Arbor, MI 48108
(313) 971-8880
List Price: $495. Upgrade from older versions, $95.
Requires: 256K RAM, two disk drives, DOS 2.1 or later.
In Short: A flexible database with an easy-to-use interface, decent relational capabilities, and limited programming capabilities. Not copy protected.

CIRCLE 691 ON READER SERVICE CARD

ly, but you may have to reenter a lot of information if you make a mistake. The routines often ask several questions, prompt "OK y/n," and reask the questions when you say "No" instead of allowing you to move the cursor back to fix the problem. These aren't fatal flaws, just little irritations.

Condor 3 has benefited much from the evolution of the Condor line of databases. It's an easy program to learn, with a good repertoire of features.—**Mike Falkner**

DataEase

If you need to use a programmable relational database but don't feel the urge to become a master programmer, *DataEase* could be just what you're looking for. With only a basic understanding of programming and relational architecture, you can easily create a database application with this $600 package from DataEase International.

Both the novice and the experienced database user will find the *DataEase* disk-based tutorial and accompanying lesson book useful. The first part, especially helpful for beginners, explains basic database concepts. Experienced database users can skip to the second half of the tutorial to learn how to create *DataEase* reports and user-defined menus. Even when you make mistakes, the tutorial never lets you get so lost that you can't recover. Users who don't want to walk through the tutorial can refer to *DataEase*'s well-documented reference manual and its 32-page quick-reference guide.

Unlike packages that use different function-key assignments depending on the program module, *DataEase*'s function-key usage is consistent throughout the package, making it easier to learn and use. It's also easy to maintain and change the applications you build with *DataEase*. You can change the appearance of screens and the data types quickly, but note that once data is entered, any change in structure also changes data.

You define fields and forms by painting. Data entry forms can take up more than one screen, but you cannot have different data entry forms for the same file. *DataEase* has special field attribute settings for limiting the entry possibilities in lookup tables and for automatically incrementing records. You define relationships and menus separately from defining individual files. When setting up a relationship between two files, you follow prompts and menus; the process is clearly explained and easy to understand. Once you've identified the two files, you enter the fields that key them together in the appropriate boxes on the screen.

ZOOM IN ON FILES *DataEase* has a very good zoom feature for use with related files. If you are entering data and cannot remember a particular code, you can hit the F10 key to access the file that is related to the file in use. To return to the original file, just hit F10 again.

To find a record that fits a set of criteria, you use *DataEase*'s data entry screen. When you enter the values in appropriate fields and hit F3, the requested record comes to the screen. If there are multiple records that fit the criteria, Alt-F3 calls up the next qualifying record. *DataEase* will display a message when no more records qualify.

DataEase offers you two ways to create reports: Quick Reports and Full Reports. Methods of selecting files, records, and report formats are similar in both cases. The major difference between Quick and Full Reports is that Full Reports are better for complex queries.

DataEase's procedural language is powerful yet easy to learn. You can program reports, using the Full Reports method, but in that process records can be entered, modified, deleted, and sorted in addition to being reported on in various ways. To create a procedure, you can have *DataEase* issue prompts that lead you through the process or, if you know the language, you can type it free-form.

TIGHT SECURITY You set up user-defined menus much as you would establish file relationships by following *DataEase*'s prompts and menus. The package offers three levels of security: database, field, and functional. The first two, which are established during menu and field definition, determine users' access to the database. Functional security determines what users may do in a file or field.

One annoying feature in *DataEase* is the inability to abort a function in progress. For example, if you decide to abort a field definition while setting up a file, you have to go through all the required steps of defining the field, with realistic responses, before the definition can be aborted. This results in unnecessary keystrokes.

There is also room for users to confuse the uses of the F2 and F8 keys. When you enter information for a new record, that record isn't actually saved until you press F2. When you update a record, F8 records the changes. When editing a record, you might mistakenly hit F2 rather than F8, which would enter a new record rather than update an existing one.

Applications developers may find that two aspects of creating menus with *DataEase* inhibit creative programming. First, *DataEase* has a set format for menu creation, allowing users to define only what the choices will be. Second, all menus must be linked to user IDs. Even a user with the highest security clearance cannot see a new menu unless it has been assigned to that user's ID.

DataEase's pluses outweigh its minuses. With enough security levels to keep the unauthorized out, a consistent user interface, prompts, and menus, as well as a programming language and a thorough tutorial and reference material, *DataEase* is a good choice for those who need to create sophisticated applications in a short amount of time.—**Patricia Becker**

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***DataEase*, Version 2.53**
DataEase International Inc.
7 Cambridge Dr.
Trumbull, CT 06611
(800) 243-5123
(203) 374-8000
List Price: $600

Requires: 512K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.

In Short: Offering prompts and menus as well as a programming language, *DataEase* is appropriate for users who need a powerful, flexible database but who do not have extensive programming experience. Not copy protected.

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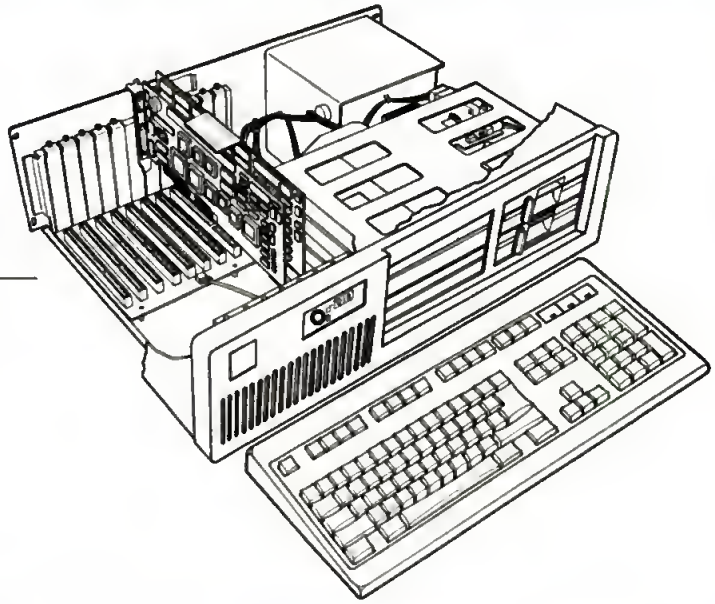
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DataEdge

DataEdge, Version 1.6, is a programmable relational database from PC Manager. The developer's primary concern seems to have been to create a powerful and flexible database-applications-generating capability, somewhat at the expense of built-in functionality. This $395 package also contains a word processor equipped with a fair range of formatting capabilities, a mail-merge feature that can accept data from the database, and a spelling checker.

Learning to use *DataEdge* is a challenge, although the well-implemented on-disk tutorial can make things a little easier. The documentation is often skimpy and vague, and the index is meager. The manual's organization also hinders its usefulness. All discussion of the database—except for the separate section covering the programming language—is laid out in the form of tutorial lessons. PC Manager apparently wanted to kill two birds with one stone, but the result is hard to use as a reference resource and too long to serve as a good tutorial introduction.

When you create data fields in *DataEdge*, you can specify that each field is to hold text, numeric data (with or without commas and decimal points), or a date. The program won't accommodate entries of more than 254 characters in length, however. You can create a list of allowable values for a field, specify allowable ranges and lengths, and establish default values, including the current date. One handy feature lets you insert fixed characters in a field—such as the parentheses, space, and hyphen in a phone number—thus saving you from typing them in each time.

You can create fields containing values derived automatically from other fields using simple arithmetic functions. More-involved calculations—such as exponential and trigonometric functions or complex date arithmetic—require *DataEdge*'s programming language.

If you give a newly created field a name that already exists in another file, the program will show you the data entry restrictions you specified for the existing field and let you either reuse them or set new ones. This can save you a lot of time if you tend to put certain fields (for example, address and phone number) in many different files. Whenever you wish to change the way a record is displayed, special screens let you rename or delete fields, add fixed text, or use the cursor keys to move fields around.

PARENTS AND CHILDREN *DataEdge* is a hierarchical database: each parent file may have child files related to it, and these in turn may have child files of their own, up to a total of 16 related files. When viewing or updating a record in a parent file, you can call up the related records from any child file.

An on-screen form lets you fill in criteria beside the appropriate field name to select specific records from a file. You can use relational and Boolean operators as well as wildcards in your selection criteria. A pair of similar forms provides a powerful global update feature, with one form for selection criteria and a second for replacement values. Unfortunately you cannot save selection criteria without resorting to programming.

One of *DataEdge*'s major weaknesses is the limitation it imposes on moving among your records. You can view records only by starting with the first record in a file or a set of selected records and then calling up each succeeding record. The only way you can view the previous record or the last record in the file is by using search criteria to call it up—if you know what to look for. A less serious aggravation is the program's inability to tell you how many records are in a file or a selection set unless you generate a report.

DataEdge can sort records in ascending or descending order, but you must first index the fields you want to sort on. Once a sort is performed, the new order of the records becomes permanent until you reindex the file.

REPORTS Report generation isn't a strong point with *DataEdge*. To specify fields to sort, average, or subtotal on and determine the output order and positions of fields, you must fill in parameters and coordinates on a very cumbersome screen. And with more than a few fields involved, it's very hard to keep the report from being cluttered and difficult to read.

Defining a complex report with *DataEdge* isn't an easy task. It took us an entire day and several calls to tech support to put together the report required for the PC Labs benchmark tests. Even then the program couldn't produce all the report elements called for by our testing script. For example, you can't sort on more than one field and then calculate subtotals unless the report is derived entirely from a single file.

Once the report is done, viewing it on-screen is also a problem. The program will let you do nothing more than scroll forward through the report a screen at a time. If you wish to browse forward and backward through the report—or jump to the end to see the record count—you must print it to disk and then call it up with a word processor. *DataEdge* will let you specify margins and add headers and page numbers to reports. There's also a preset mailing label format.

PAL PROGRAMMING *DataEdge* offers a powerful but complex Programmer Application Language (PAL) that lets you beef up the functionality of the database considerably. The package also includes a full-screen program editor, a compiler, and a debugger.

A PAL program takes control of processing at a specific point in database operation—when you open or close a particular parent file, access a particular child file or record field, enter update mode, or create a new record. You can specify that a program should run automatically each time you open the file to which it's linked.

PC MAGAZINE FACT FILE



***DataEdge*, Version 1.6**
PC Manager Inc.
8229 Boone Blvd.,
#202
Vienna, VA 22180
(800) 654-5845
(703) 356-4600
List Price: $395

Requires: 256K RAM, two disk drives, DOS 2.0 or later.

In Short: *DataEdge* offers a powerful programming language and menu-generating capability. Unfortunately, its built-in capabilities for viewing records and reporting are limited. Not copy protected.

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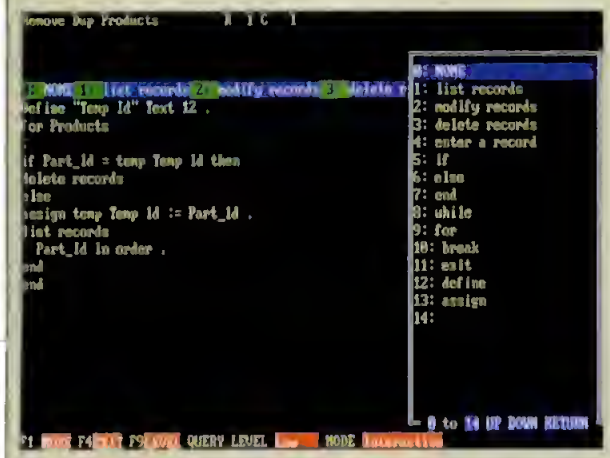
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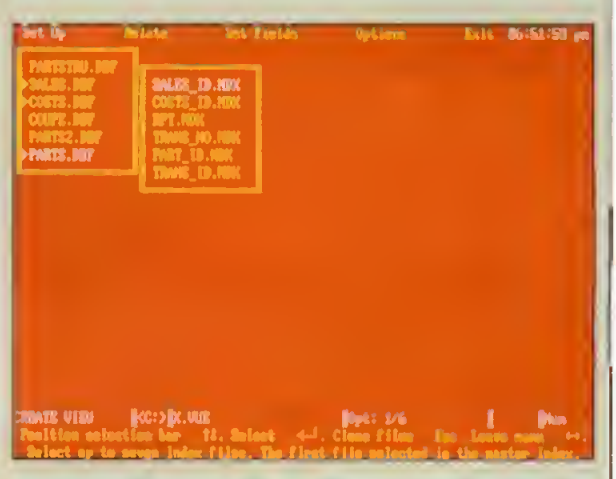
DataEase *records may be added, deleted, or updated through the program's excellent procedural language, accessible through the Full Reports section.*



DataEdge *lets you enter selection criteria for viewing selected records or making global updates. The relational operators and wildcards available are shown at the top of the screen.*



The **DataFlex** *query system allows you to build multifile relational reports, complete with headers and breakpoints, just by pointing at the fields you want.*



As a means of organizing individual files in **dBASE III Plus,** *the Create View command enables users to create a subset of records and fields to be displayed or updated in a database.*

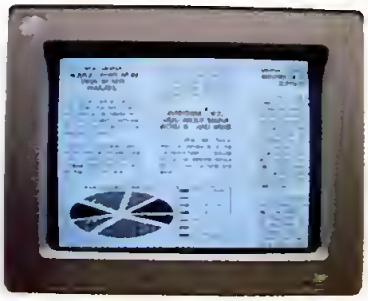
Whenever you open a file, you also have the option of running a PAL program by selecting it from a menu.

DataEdge supplies a number of sample programs on disk that perform such functions as converting all entries in a state abbreviation field to uppercase, filling in full or partial ZIP codes automatically for specific cities, and creating menus for generating reports from saved report criteria. There's even one that displays in column format the first few fields from all the records of a file and then lets you use this as a menu for selecting a record to view or update. The manual contains discussions of most of the sample programs, and you can modify them to use with your own files. Unfortunately, some of these programs contain bugs that keep them from running properly, and others tend to run slowly.

In addition to the menu creation capabilities of *DataEdge*'s programming language, there's also the Panel Controller, which provides a relatively simple way of customizing many of the system menus or creating your own. You can also write your own context-sensitive help screens as you need them.

DataEdge's programming language is a powerful tool for creating custom database applications over which you have a high degree of control, right down to the menus and help screens. But if you don't plan to make extensive use of the programming language (and it's not designed for amateurs), you'd be better off with another database. The mediocre documentation, the constraints on viewing records, and the awkwardness and limitations of the report-

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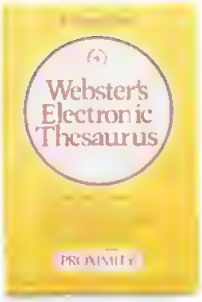
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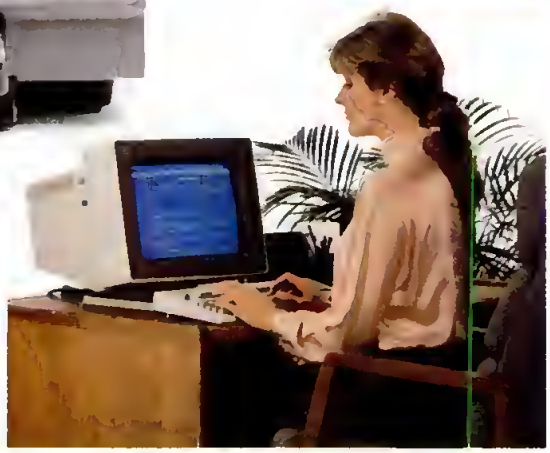






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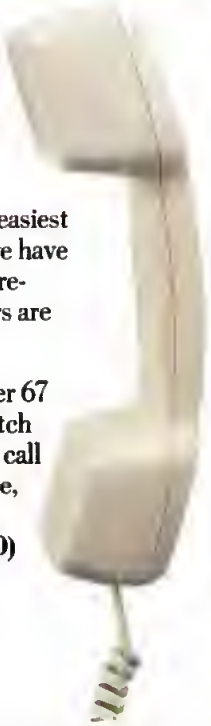




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ing facility weigh heavily against this product when it's compared with others on the market.—**Robert Kendall**

DataFlex

Data Access Corp.'s *DataFlex* is a $695 old-timer that remains a strong contender in the database market. First developed for CP/M systems, it reigned among the first databases for microcomputers that supported true multi-user applications. Today, in fact, most *DataFlex* developers specialize in multiuser applications.

DataFlex's greatest strengths are its multiuser features and portability among a variety of operating systems. Besides the usual file- and record-locking functions, *DataFlex* includes an automatic record reread so that you can write applications that allow multiple users to access the same record at the same time. You can run *DataFlex* under CP/M, DOS, UNIX, and even VAX/VMS.

Unlike *R:base*, *dBASE*, and many other DBMSs, *DataFlex* has no "global operators" (like *dBASE*'s Replace All), which affect all the records of a data file. For example, if you want to raise everyone's salary by 10 percent, you have to write a short program that loops through the file and modifies each record. Also missing are relational verbs like Project and Join, but these also can be simulated by programs without much difficulty.

Unfortunately for *DataFlex*, the PC Labs benchmark tests were designed for programs that let you enter global operators from a command prompt. Hence, *DataFlex*'s performance on these tests suffered because *DataFlex* included numerous short programs written to accomplish what a global operator might do.

But don't let this scare you off: performance in real applications proves better than the benchmark tests indicate. And *DataFlex* isn't *that* hard to use. You can define your data file and create a complete data entry/edit application just by painting the screen with your favorite text editor, using underlines to indicate data areas, and answering a few questions regarding the name of field, key status, and indicating numeric or character. You get preprogrammed keys for finding a record using any index key, clearing data, deleting a record, and browsing forward and backward through the file.

It will take you only a few minutes to add data validation commands in order to request a customer code, check it against the customer file, or do almost anything else you want. A file lookup that takes the place of 5 to 10 lines of *dBASE* code, {FINDREQUIRED}, can be entered next to the field entry command. *DataFlex* has over 20 data validation functions, including range and list verification. This may be the most powerful data entry system you'll ever use.

EASY REPORT GENERATION You can also generate reports without writing a line of code. *DataFlex*'s query function can create multifile relational reports, complete with headers and breakpoints, just by pointing at the fields you want. You can save the results as *DataFlex* programs and modify the code to create really fancy reports. If you don't like the layout, just draw a new one the same way you drew the input screen. Even the file import facility is a code generator.

Once you have the input and output coded, you can build menus or modify the *DataFlex* system menus to tie them all together. Simple applications need very little programming.

One part of *DataFlex* that could use some improvement is the field definition program. If you want to change your file format, you have to export the file to ASCII, make the changes, and then read the data back in. Many *DataFlex* programmers define some empty space in their files, just in case they need to add a field.

SPACE SAVER *DataFlex* automatically reuses deleted records, eliminating the occasional need to pack the database. You can also preallocate disk space for your files, either for multiuser operating systems that require it or for avoiding fragmentation of files to ensure maximum performance.

Old *DataFlex* users will be glad to see a full set of graphics commands, general expressions, and a much faster compiler. Some developers may want to use Data Access's C library to access *DataFlex* files from C programs.

My only other complaint is that the technical support lines seem to be busy pretty often; it always required two or three tries to get through. Once you're connected, help is only seconds away: the staff does know the product.

Overall, *DataFlex* is a powerful programming environment for the serious applications developer. You should look at it if you're developing multiuser applications, especially if they must run on both PCs and minicomputers.
—**Howard Marks**

PC MAGAZINE FACT FILE



***DataFlex*, Version 2.3**
Data Access Corp.
14000 SW 119th Ave.
Miami, FL 33186
(800) 451-FLEX
(305) 238-0012
List Price: Single-user, $695; multiuser, $1,250.
Requires: 384K RAM, hard disk drive, DOS 2.0 or later
In Short: More a development system than an end-user tool, *DataFlex* has top-notch multiuser and data entry functions. Also runs under CP/M, UNIX, and VAX-VMS. Not copy protected.

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dBASE III Plus
dBASE IV

Ashton-Tate Corp.'s *dBASE III Plus*, Version 1.1 ($695), is the most recent incarnation of the elder statesman of microcomputer database systems. To *PC Magazine* readers, it is probably the most widely known programmable DBMS. Replete with a sophisticated database manager, a rich programming language, a flexible applications development environment, a report generator, and networking facilities, *dBASE III Plus* has set a standard for MS-DOS–based DBMSs.

Unfortunately, *dBASE III Plus* is showing signs of age.

Fortunately, *dBASE IV* (which commenced its beta-test cycle when this review was being written) is just around the corner. Not only does *dBASE IV* incorporate intelligent and meaningful enhance-

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*InfoWorld, December 1987.

Hardware Specifications: Requires PC/MS-DOS version 2.0 or higher with 384K of usable memory and a minimum 10 MB hard disk. For use with the IBM® PC, PC XT, PC AT, Personal System/2™ and compatibles. 3½" media optionally available. Not copy protected.

Lotus 1-2-3 is a registered trademark of Lotus Development Corporation. dBASE is a registered trademark of Ashton-Tate Corporation. Timeslips and Time-Link: Plus III are trademarks of North Edge Software Corp. IBM is a registered trademark and Personal System/2 is a trademark of International Business Machines.

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ments to the *dBASE* programming environment and a new, more powerful user interface, but it also has complete relational database capabilities and a full-fledged implementation of SQL.

While *dBASE III Plus* is among the finest of the current crop of PC software this side of *Microsoft Windows*, it is lacking in contemporary relational database technology. Rather than presenting a high-level interface that allows you to see the database as a collection of tables and views, *dBASE III Plus* is really *dBASE III* with a relational bag on its head. Moreover, while beginners will find that Ashton-Tate has included numerous facilities for learning *dBASE* quickly and painlessly, experienced database users will probably find more-productive *dBASE* development environments elsewhere.

dBASE III Plus is smartly and slickly packaged. It comes with two massive binders of documentation and software on seven 5¼-inch and four 3½-inch floppy disks in a large case. Besides the main program, an on-disk tutorial, an Applications Generator, and a networking version of the program are included.

Beginners will find the documentation extensive and well organized. Divided into two volumes, the first is a complete reference for *dBASE* from the ground up. It includes a detailed guide through the basics of *dBASE*, the Assistant (a pull-down menu interface to the program), the Report Generator, and the 200-plus commands and functions that compose the *dBASE* programming language.

The programs and features discussed in this volume are designed with the novice in mind. The Assistant, which automatically takes control when you boot *dBASE*, is powerful enough to guide a new user through the design of simple databases. The Query Editor walks you through the construction of complex queries, and the Screen Generator helps you build customized data entry screens.

INTRO TO PROGRAMMING The second volume proves what the cognoscenti have been saying about *dBASE* for years: to get the most out of it, you'll have to do some programming with it. With this in mind, this volume offers an excellent introduction to programming in general, with emphasis on the *dBASE* language in particular.

It also contains a guide to writing *dBASE* application programs to run on a LAN. Another section covers the use of Runtime+, a set of programs for compiling *dBASE* applications that you can then market. Last of all are instructions for using AppsGen, a *dBASE* program for generating simple, menu-driven application programs.

The *dBASE* programming environment itself has become a standard in the PC database development marketplace. It sports both indexed and non-indexed data retrieval mechanisms, complex sorting, simple data types, and Pascal-like program control keywords. It also has commands for configuring the user environment.

Unfortunately, while *dBASE III Plus* borrows from some of the mechanisms of the relational database model, its lack of a real relational interface is one of its greatest weaknesses, and one of the primary faults that Ashton-Tate has resolved in *dBASE IV*.

In a relational database system, you are not aware of the various components of the database other than the tables that compose it; database objects other than tables are transparent to you. However, whether you work with *dBASE* at the program or command level, you'll find yourself constantly managing a multitude of database objects in the form of DOS disk files: database files, indexes, views, catalogs, query files and format files, and so on.

The key to organizing *dBASE* files is via catalogs and views: the former specifies a set of files to be used, and the latter shifts the focus from one subset of the catalog to another. Views can even specify which fields are available for update and retrieval in a database file.

Catalogs and views lend a certain relational feel to *dBASE*, and, once created, they lessen your concern with the individual files they organize. These are useful tools for the novice's simple databases. But if you are an applications developer, the illusion of relationality is lost once you realize that you still have to manage these subcomponents yourself.

For example, inadvertently deleting an index used by a view and issuing the Set View command generates the mysterious "File Does Not Exist" message. You have no way of knowing what file is missing, and there is no facility within *dBASE* to rebuild the index for you: you have to know precisely which key was used and which database file had the index.

From an applications developer's perspective, there is no way to hide the details of the database from application programs (as you can do with embedded SQL). Nor is there any way to perform true relational algebra with *dBASE*.

In general, *dBASE III Plus* could use a few other improvements. Its speed is OK, but it's easily outperformed by the better *dBASE* clones. Although the networking version comes standard with *dBASE*, a "bump" disk must be purchased for every five users. Also, some *dBASE* network commands (like Report) have the annoying habit of locking other users out from the files that they're working on, even though the file is not being written to.

PC MAGAZINE FACT FILE



***dBASE III Plus*, Version 1.1**
dBASE IV
Ashton-Tate Corp.
20101 Hamilton Ave.
Torrance, CA 90502-1319
(213) 329-8000

List Price: *dBASE III Plus*, $695; *dBASE IV*, $795; *dBASE IV Developer's Edition*, $1,295. Upgrade on *III Plus* purchased between February 17 and July 31, $30. Upgrade to *dBASE IV* DOS from current *dBASE II*, *III*, and *III Plus*, $175; to *dBASE IV* OS/2, $275.

Requires: 256K RAM, two disk drives, DOS 2.0 or later.

In Short: The standard setter among PC-based programmable DBMSs, *dBASE III Plus* has a flexible applications development environment, a sophisticated database manager and report generator, a rich programming language, and network facilities—but is still showing signs of age. Foretelling the future of micro-based DBMSs, *dBASE IV* (reviewed in beta version) corrects many of its predecessor's deficiencies and adds complete relational capabilities and a full-fledged implementation of SQL, as well as strengthening the user interface and programming environment. Not copy protected.

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FASTBACKplus Version 1.0
Genoa Version 2.13 A
Irwin Version 1.13
SY-STOR Version 1.0
SY-TOS Version 2.02 E
TakeTwo Version 2.0

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INTRODUCING dBASE IV While *dBASE III Plus* does present a view of end-user PC database management that's comprehensive and consistent for novices, it badly needs a real relational interface. And that's just the kind of face-lift it's getting with *dBASE IV* ($795), Ashton-Tate's elegant, eloquent answer to the weaknesses and deficiencies of *dBASE III Plus*.

Installing *dBASE IV* is easy. An installation program takes you through the steps of configuring *dBASE* for your hardware environment, creating directories, and copying the software to your hard disk. It may be the most comprehensive installation program I've ever seen. A number of the installation parameters are written to the *dBASE* CONFIG.DB file in the directory in which *dBASE IV* is installed.

The first thing you'll notice when you run *dBASE IV* is that while the dot prompt is still there, it's now almost superfluous. Instead of *dBASE III Plus*'s Assistant, a new and completely integrated user interface called the Control Center coordinates database design, data manipulation, query editing, report generation, label design, and view creation. You can use the Control Center to monitor all of the files in a system and how you work with them; it makes the dot prompt virtually obsolete. Access to the Control Center is via pull-down, point-and-shoot menus.

If, however, you still prefer a command-driven approach, you'll find that the *dBASE IV* command-line now accepts up to 1,024 characters of *dBASE* instructions. While this is also true for program lines, it's almost overkill: most program editors can't handle lines that long (although the *dBASE IV* built-in editor does). Command-line syntax errors can now be edited as they occur, and a number of other features (such as a superb 43-line EGA mode) generally make *dBASE IV* much easier to use than its predecessors.

dBASE IV's facilities for data entry markedly improve on those offered in *dBASE III Plus*. You can now specify default values and ranges for a field, tie in field data validation and formatting, and define the conditions for field editing. All of this is stored in the header of the database file and is handled automatically.

Improvements to the *dBASE* file manager itself include transaction-level processing with transaction logging, and rollback with data integrity checking. You can specify up to 255 fields per record and relate one file to two or more other files at the same time.

A wonderful new facility in *dBASE IV* is the creation of "production" indexes when a database (.DBF) file is created. These new index (.MDX) files can manage nearly 50 different indexes on a single .DBF file, all of which are updated automatically when changes are made to the database (you're not obligated to specify these indexes when using a database file). Moreover, while *dBASE IV* maintains compatibility with *dBASE III Plus* indexes, it also allows descending indexes to be created on character field keys.

PROGRAMMING ENVIRONMENT *dBASE IV*'s programming environment shows considerable enhancement compared with that of *dBASE III Plus*. First, a built-in pseudo-compiler can automatically interpret and parse program, procedure, and format files to produce intermediate object code. The object code files (.DBO) can optionally be linked into one large object file. Additionally, procedures can now be stored in any program file, and, once compiled, those procedures can be called from any other program.

dBASE IV lets you create up to 2,048 memory variables and offers memory arrays with up to 1,023 elements each. A variety of new commands can generate, display and manage pop-up windows and menus. Besides these, system variables now exist to manipulate printer alignment, indentation, margins, tabs, word wrap, paper advance, page numbers, and so on. You can reset any of these in your programs on the fly.

Both an on-line windowing debugger and a program cross-reference utility are now available, the latter for checking control structures, indenting *dBASE* code and generating system flowcharts. A number of new math, trigonometric, financial, and statistical functions have also been added, as well as user-defined functions that have been available in other programs for some time.

Other general improvements include the ability to open up to 99 files at a time, trap the DOS Critical Error Handler, and check disk space prior to expanding files. Additionally, the old numeric data type found in *dBASE III Plus* now handles fixed-point data, and a new floating-point data type has been added. You can import and export a number of new file formats, as well as create and use keyboard macros. Even the on-line help has been improved through the addition of a number of layers and windows.

BIG IMPROVEMENT If that weren't enough, the really *big* news about *dBASE IV* is the addition of full relational database capabilities with a complete implementation of SQL (both embedded and interactive). By issuing the Set SQL On command (or placing SQL=On in CONFIG.DB), the dot prompt becomes an SQL prompt that accepts the same operators as does IBM's mainframe-based database, DB2.

Issuing the Create Database command creates a DOS directory of .DBF files whose names and purposes correspond to such DB2 system catalogs as SYSCOLS, SYSIDXS, SYSTABLS, and so on. These keep track of the components of the database (columns, table names, authorizations, and so on). In fact, *dBASE IV* maintains a master set of system tables in a directory called SQLHOME, which it creates when you install *dBASE IV*.

You can incorporate *dBASE III Plus* .DBF files and indexes into a *dBASE IV* SQL database by issuing the DBDefine command. From that point on, those files are accessible via both *dBASE IV* and *dBASE IV* SQL commands. From the SQL perspective however, these .DBFs and .NDXs are no longer viewed as DOS files that you or one of your programs would have to relate and manage. Instead, *dBASE IV* SQL properly views them as components of a "relational database"—that is, a collection of tables in which the underlying storage apparatus is transparent to the user.

dBASE IV lets you store SQL statements and queries in files with a .PRS extension, which can call *dBASE* programs (and vice versa: *dBASE IV* switches between SQL and *dBASE* mode automatically). While *dBASE* commands that perform file I/O (such as Use, Replace, or Append) cannot be used in SQL mode, the prepon-

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derance of *dBASE* commands and functions (including control-flow commands like If and While) are available.

Moreover, *dBASE IV* SQL offers Cursor-based operations, letting you place the results of an SQL Select operation into an SQL Cursor (again, just like DB2). The SQL Fetch operator is available to move Selected rows from the Cursor into *dBASE* variables. Using SQL operations implies that you no longer need to use *dBASE* commands for retrievals and updates since SQL, with its far more powerful, set-based relational operations, can be used instead.

This change has had profound implications on *dBASE* programming. While SQL was designed as a database definition and manipulation language, *dBASE* has never been particularly strong in respect to language (each command having originated as a series of small programs that were later bound into one). This weakness becomes more obvious when you notice how many *dBASE* commands are required to perform the equivalent of one SQL operation. Yet in recent years, the addition of new commands and functions has improved *dBASE* as a high-level applications development language. If you add *dBASE IV*'s new functions and commands to the existing ones, then *dBASE* becomes a powerful applications development framework for programmers.

EXCELLENT TUTORIAL The SQL section of the *dBASE IV* manual (which was still being edited at the time of this writing) contains one of the best tutorials and introductions to relational databases in general—and SQL in particular—that I have ever seen. It goes into great detail on how to create databases and how to use SQL as a query language and has a number of examples and diagrams.

The PC Labs benchmark tests show that although *dBASE IV* may not be the fastest database on the market, it is considerably faster than *dBASE III Plus* and is closing in on some of its competitors. For example, *dBASE IV* is nearly twice as fast at indexing as is *dBASE III Plus*. Sorts and text updates are 30 percent faster, and math updates take half as long as they did previously. In addition, copies (from one database to another) are as much as four times faster, and a PACK with an index is as much as 2.5 times faster.

Clearly *dBASE IV* is not a simple upgrade but a sophisticated tool that represents the way of the future for micro-based DBMSs. Its long-term strength, which will become even more apparent when the OS/2 version comes out, is its capacity as an SQL applications development platform. With *dBASE IV*, Ashton-Tate has practically outdone itself.

—Richard Hale Shaw

DB-Fabs

DB-Fabs, Version 2.3d, from Computer Control Systems (CCS), is a $295 programmable DBMS with both a command-line interface and a high-level language development system. Designed for novices and developers alike, *DB-Fabs* includes a command-driven module for manipulating databases, screens, and reports; a proprietary database language with its own compiler and run-time modules; and libraries for embedding database commands in C, Pascal, and BASIC programs. Thus, *DB-Fabs* does not limit you to one particular approach to database management.

At first glance a *DB-Fabs* database resembles one in *dBASE*, since each is stored in separate DOS files and named with a .DBF extension. Indexes are also stored in separate files, but they retain the same name as the database to which they belong, and they have extensions of .I00, .I01, and so on. This naming scheme lets *DB-Fabs* associate each index with the appropriate database file and update the index automatically when the database has been modified—something that *dBASE* and its look-alikes cannot do.

Several utilities are provided to convert between *DB-Fabs* database files and other formats, including BASIC data files, *dBASE III* files, and comma-delimited ASCII files. Unfortunately, there is no facility for importing the *dBASE III* files directly. And while I found that the conversion programs were fast, they were also somewhat unforgiving: a path to an input file in another directory was not allowed, and if I elected to overwrite an empty database (instead of appending to it) the program would hang the machine. These kinds of errors should be trapped.

DB-Fabs supports only two types of database fields: character (up to 255 characters long) and numeric. The numeric fields can support both floating-point values (to 14 decimal places), and long integer values. While the current version permitted only 65,535 records per database, I was told by CCS technical support staff that the number would be expanded in Version 3.0, which should be available by the publication date of this review.

DB-Fabs limits databases to 64 fields per record. When I asked CCS about this, I was told that another version, which supports up to 128 fields per database, is available and also costs $295.

DB-Fabs commands are similar to those of *dBASE*, including over 40 commands for manipulating databases, creating screens, and generating reports. Three-letter command abbreviations are acceptable to the command-line interpreter, making it easy to issue complicated statements with few keystrokes. And macros can assign strings of up to 200 characters to any key, a facility that is also available to programs utilizing the high-level language interface.

The documentation is adequately organized, yet there is little indication of how to go about installing the product, although a setup utility is provided for modifying the

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***DB-Fabs*, Version 2.3d**
Computer Control Systems Inc.
Route 3, Box 168
Lake City, FL 32055
(904) 752-0912
List Price: $295; network version, $395.
Requires: 256K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: With a command-line interface, a proprietary language, and interfaces to such high-level languages as C, Pascal, and BASIC, *DB-Fabs* offers numerous approaches to database management. The package could be strengthened by the addition of a global error and status variable and a global pointer to a record buffer, as well as some improvements to the idiosyncratic user interface. Not copy protected.

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main program and run-time modules. You can configure screen colors, function-key assignments, and printer attributes.

QUIRKY INTERFACE I found a number of idiosyncrasies about the command-line interface annoying. For instance, when you create a new database, only 16 fields can be defined at a time. Once you move to the next 16 fields, you can't go back to view or change the previous ones. Instead, you have to return to the command line and issue a command to get back where you were. Also, underlines are not allowed as legal field name characters. Why not? Everybody else allows them.

Other aggravations included a number of commands that cleared the screen arbitrarily, in particular List and Delete. In addition, I found that command-line searches are case insensitive: "List for color= "ROSE" " will yield the same result as "List for color="rose" " regardless of how the contents of the color field are stored. This is acceptable if you're not sure what you're looking for—but terribly nonstandard—and worse if you're trying to be precise.

The *DB-Fabs* report writer gives you considerable flexibility, allowing you to attach brief programs to reports so that the fields and variables used in them can be manipulated. Unfortunately, the Alter Report command produced a number of lost clusters on my disk (as reported by CHKDSK). I verified this more than once on two different systems.

An additional 33 commands can be embedded in high-level-language programs. You can learn the *DB-Fabs* commands in an interpreted command-line mode and call them from a C (or BASIC or Pascal) program when you are more familiar with them. This eliminates the need for the high-level-language program to get directly involved with database manipulation.

DABBLE IN DABL The proprietary database language, DABL, includes a combination of *DB-Fabs* and BASIC commands. While anyone familiar with BASIC will be able to pick it up quickly, it utilizes labels instead of line numbers for control flow. In this respect, DABL tends to resemble well-structured assembler, which is not a bad feature. A DABL compiler is included, and the resultant object modules can then be run with DRunI, the DABL runtime module.

Programs written in DABL or a high-level language have to be run with the *DB-Fabs* runtime modules. Optionally, these can be run as terminate-and-stay-resident (TSR) programs, and a utility is provided for removing them from memory. Because the runtime modules are TSR programs, you don't have to link a lot of database routines into your application program. Instead, these are stored in the runtime modules and accessed via a software interrupt or a far call.

The high-level-language interfaces accommodate Microsoft BASIC, Lattice C, and Microsoft Pascal. (*DB-Fabs*, Version 3.0, will include interfaces for Microsoft C and Microsoft FORTRAN.) *DB-Fabs* commands can be embedded in the source code of the other languages.

For instance, a function called drunc() is provided for C. A C program can call this function, passing it the appropriate *DB-Fabs* command. Additional parameters to this function include pointers to the fields of the current database record and variables for checking error-return codes. The system is not unlike Embedded SQL in this respect, and the same scheme is used throughout the three high-level-language interfaces.

CAN'T OUTRUN FOX *DB-Fabs* is not as spectacular a performer as I would have expected. While the documentation indicates that the program is written entirely in assembler for speed, our tests showed that *FoxBase Plus* (written in C) outran *DB-Fabs* on some tests, especially when building indexes. I suspect that Fox Software could teach CCS a few things about algorithms.

Although the manual contains a well-written tutorial, and rudimentary on-line help is available, they're both brief and don't stand up when compared to the massive amount of aid provided with better-known products such as *dBASE III Plus*.

In addition to the problems with the user interface mentioned above, I found that the screen colors aren't set properly when you exit the program: instead of having them set permanently (as they are in *dBASE* and *FoxBase*) or turned off at once, the background reverts to black and the foreground remains set for several operations afterward. Also, when a database operation is in progress, there is no indication of what's going on other than "Please wait. . . ."

I would like to see the high-level-language interface cleaned up. For example, the additions of a global error and status variable and a global pointer to a record buffer, which could be accessed as a C structure, would eliminate the need to pass the same parameters again and again to drunc() and would reduce the code size in large applications. Another welcome addition would be a global variable for keeping track of the address of DBRun, which is also passed to drunc() every time it's called. I couldn't understand this: after all, once it's loaded, the address of DBRun isn't going to change.

Despite needing some improvements, *DB-Fabs* has a lot to offer. It's especially good to know that once you have solved a problem in the command-line mode, you have the flexibility of embedding the solution in a C, Pascal, BASIC, or DABL program.—**Richard Hale Shaw**

dBMAN

It's been said that imitation is the sincerest form of flattery. If that's the case, then *dBASE* has many flatterers. Among them is VersaSoft Corp.'s *dBMAN*, a $249.95 program that is database file and program compatible with *dBASE III Plus*. *dBMAN* competes directly with *dBASE III Plus;* it runs many operations much more quickly and costs less than half the price.

dBMAN's manual is quite complete. A Basic section covers the fundamentals of using the program and includes a keystroke tutorial. The Advance [*sic*] section, which covers such topics as data validation, error trapping, and parameter passing, makes ample use of examples but has no tutorial—an appropriate decision. The Reference section details command and function syntax and file specifications. The Commands and Functions sections contain definitions and supply precise descriptions of their respective elements. Program error messages and keywords are listed in the appendix.

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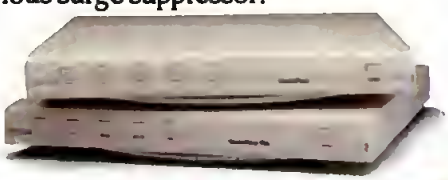
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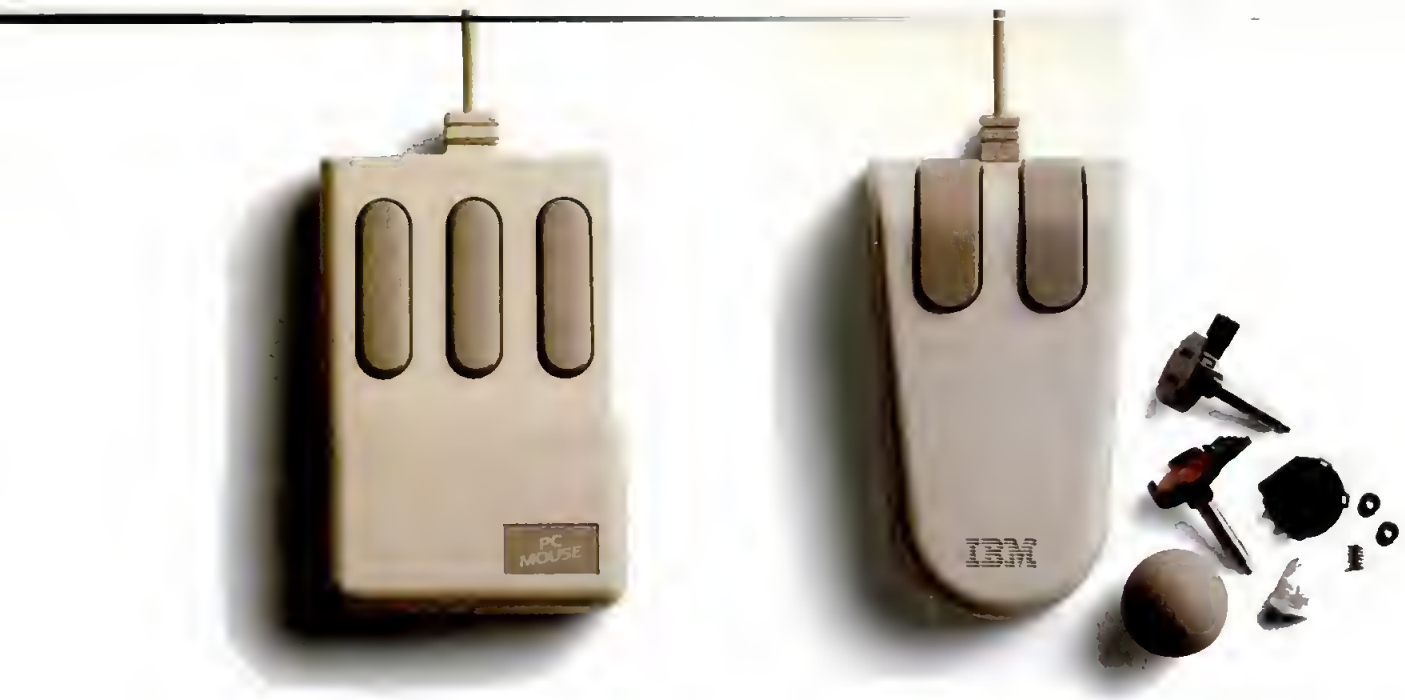
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***dBMAN*, Version 4.00U**
VersaSoft Corp.
4340 Almaden Expy., #250
San Jose, CA 95118
(408) 723-9044
List Price: $249.95
Requires: 320K RAM, one disk drive, DOS 2.0 or later.
In Short: Database file and program compatible with *dBASE III Plus*, *dBMAN* has an improved debugging facility, relatively simple data validation and error recovery, and other features that make it easy to work with. Although *dBMAN* sorts databases faster than *dBASE III Plus*, it is slower at indexing them and the resultant index files are not *dBASE* compatible. Not copy protected.
CIRCLE 647 ON READER SERVICE CARD

work in a direct command mode or in a prompted, menu-controlled Assist mode. The Assist mode is a 45K *dBMAN* program file that can be used to study *dBMAN* programming techniques. *dBMAN*'s Assist runs somewhat slower than the corresponding program in *dBASE III Plus* and uses full-screen forms. *dBASE*'s approach is more modular. *dBMAN* follows the same field and file structure rules as *dBASE*, except that *dBMAN* does not work with Memo fields.

Although *dBMAN* index files are not currently compatible with those of *dBASE*, they will be with the next release of the package, according to a VersaSoft spokesman. With *dBMAN*, the indexing process is significantly slower than with *dBASE*. However, *dBMAN* sorts faster than *dBASE*, which partially makes up for its slowness in indexing.

dBMAN comes with several debugging and development tools that make an application programmer's life easier. Command file debugging, for example, allows you to run a *dBMAN* program file, stop it when there is a problem, modify the program, and then have the program resume execution. *dBMAN* has no full-screen editor for programming or even much of a line editor, but you can replace individual program lines while debugging your program.

Another nice feature is *dBMAN*'s selection of menu commands. *dBMAN* has built-in functions that make it easy to design user menus in either vertical, horizontal, or pop-up configurations.

THREE-LEVEL VALIDATION *dBMAN* allows you to do quick-entry data validation on three levels. The first level accepts only entries that are appropriate for a given field type; for example, you cannot enter letters in a numeric field. The second level allows you to specify a data Picture to force entered data to fit the Picture (such as the combination of letters and numbers in an ID code or user password). *dBMAN*'s third level of data validation is achieved through the GetFile/Read function, which forces a file to accept only data that matches entries in another validation file.

dBMAN's security features include the ability to password-protect databases and to protect individual fields from being read or written to. *dBMAN* also uses a proprietary data encryption scheme to scramble data.

Priced at less than half the cost of *dBASE III Plus*, *dBMAN* offers some functions, such as command file debugging and a selection of menu commands, that make it a more pleasant product with which to develop applications. However, those pluses must be weighed against *dBMAN*'s current limitations, which include its lack of a program editor and Memo fields, a slower indexing function, and indexes that are incompatible with *dBASE III Plus*.—**Bruce Brown**

db_Vista III

Raima Corp.'s *db_Vista III*, Version 3.0, is a powerful $595 DBMS designed for C programmers who wish to develop database applications in C.

Unlike many of the other DBMSs reviewed in this issue, *db_Vista* is not built on the relational database model. Its authors concluded that the network database model is more efficient and more appropriate in a database development environment. DBMSs based on the network model were the rage among database aficionados a few years ago and still have a loyal following. Both mainframe and minicomputer DBMSs (such as IDMS and

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***db_Vista III*, Version 3.0**
Raima Corp.
3055 11th Ave. NE
Bellevue, WA 98004
(206) 828-4636
List Price: $595
Requires: 256K RAM, hard disk, DOS 3.0 or later.
In Short: *db_Vista III*, is a network-type database program designed for C programmers who want to develop royalty-free database applications in C. *db_Query* is an optional SQL-based relational interface. Not copy protected.
CIRCLE 663 ON READER SERVICE CARD

MDBS, respectively) have been built on the network model.

Unlike the relational model, where a database is viewed as a collection of tables, the network model has data organized by record types, which are defined and maintained through sets. These sets are used to describe one-to-many relationships among the various record types, resulting in a network of interconnected records.

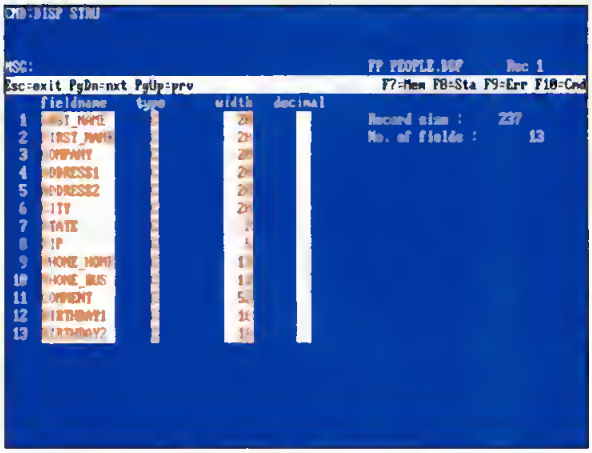
Raima also offers an interface called *db_Query*, Version 2.0. Priced at $595 for a single user and $990 with source code, *db_Query* provides a relational front-end to *db_Vista* databases, using an SQL subset and a few extensions. Using *db_Query*, users get a complete relational "view" of a network database.

Applications developed with *db_Vista* and *db_Query* can be distributed royalty-free. Thus, C developers can create stand-alone end-user database applications that include an SQL-based query interface, without forcing end users to purchase an additional DBMS program: the DBMS and the application are distributed as one program.

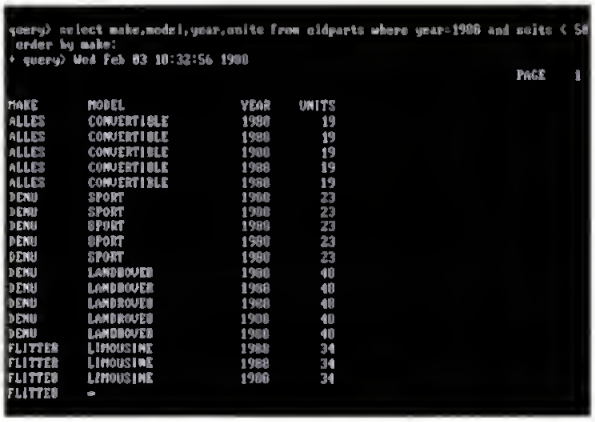
MODEL DOCUMENTATION *db_Vista* comes with two well-organized, well-indexed, cross-referenced manuals (a separate manual comes with *db_Query*). An excellent discussion of the network model is given in the documentation, and a complete tutorial (with examples) is pro-



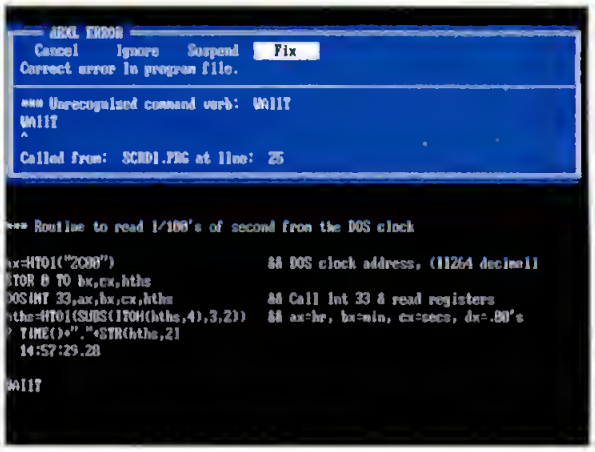
The List command in **DB-Fabs** *always clears the screen when scrolling, obliterating the results of any previous command. Note that the bottom line displays the names of the current file, form, and index in use.*



dBMAN *creates and uses* dBASE III Plus*–compatible files. It is also command compatible and allows you to type four-letter abbreviations of commands to invoke them.*



db_Query, **db_Vista***'s relational interface, lets you perform a complex SQL query on a* db_Vista *network database. A query result, as shown here, can be formatted for a report or written to a number of different file formats.*



When an error occurs in **dBXL Diamond Release** *and you choose to "Fix" it, the editor moves the cursor to the offending line and reissues the command until you've made your changes.*

vided for writing programs with *db_Vista*. Even a technical dissection of the structure of *db_Vista* databases is included.

The disks contain C program libraries and a dozen different utility programs. There is no end-user interface to the database: it's not necessary because this DBMS was not intended for end users. However, the utility programs can perform database integrity checking and full-screen viewing and editing of database records.

Just as when developing any database application, one of the first tasks you face with is *db_Vista* is deciding how to organize your data (what records and indexes to create, and what sets, if any, will link the records). With *db_Vista*, you create a schema in the program's schema language, which resembles C and supports all C data types. The schema is then submitted to a compiler, which will create the database dictionary and a C header (.H) file; this file, which can be included in your application code, defines the records described in the schema as C structures. Once you initialize the database (using another utility) and write your application, you're ready to roll. Raima provides versions of *db_Vista* for linking with Lattice C, Microsoft C, Aztec C, CI, and *DeSmet*.

DELIGHTFUL RETRIEVAL I found using *db_Query* delightful. It accepts a healthy subset of SQL and includes extensions that make network sets look like relational views. Since *db_Query* is strictly a retrieval mechanism, Update, Insert, and Delete are not supported. The query optimizer is efficient, and Raima assured me

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improvements are being made that will help it exceed the performance of the version we tested.

While the results of Selects go to the screen by default, you can divert them to .DIF and ASCII files for use by other programs. You can also store complex query statements in ASCII files and rerun them on command. Finally, you can configure the *db_Query* environment for every database it is run against. The configuration options include field output formatting (such as money, date, and time formats), report headings, bodies, and footers.

You can use *db_Query* as a standalone query interface to your *db_Vista* databases, or you can link it to your C programs and make it part of your application. After studying the source code, I found that it would be easy to build an entire query editor around the entry points to the query analyzer.

Since *db_Vista* addresses only pure database management needs, it does not include data entry functions in its libraries, although utilities are available for importing data from ASCII files. Another utility, *db_Revise*, is available ($595, or $1,980 with source code) to make changes to the data dictionaries of existing databases.

■ *db_Vista* is a fast performer when the database is configured correctly.

db_Vista is not always the fastest kid on the block, but it is a fast performer when the database is configured correctly. While you gain speed executing searches and retrievals, adding new records and making set connections can really slow things down.

In addition to the standard MS-DOS version, multiuser DOS and UNIX versions are available. An OS/2 version is scheduled for release later this year.

In summary, *db_Vista* is not for the novice, nor is it for the applications developer who is not fluent in C. It does, however, give developers the ability to build complete, standalone applications with a full-featured relational front-end. If you are planning to write database application programs and want to write them in C, then *db_Vista* merits your serious consideration.—**Richard Hale Shaw**

dBXL Diamond Release

Wordtech Systems calls *dBXL Diamond Release* "the *dBASE III Plus* SuperClone" with good reason. The $199 program offers maximum *dBASE* compatibility (including .NDXs) at perhaps double the speed.

For new users, *dBXL* is the easiest to learn of all interpreters; for experts, *dBXL* adds over 50 extensions to *dBASE*'s array of features. Some of these—full windowing, graphs, hooks to desktop publishers, multidimensional arrays, and easy access to DOS interrupts—are unique. Many users will find them irresistible.

Except for a handful of lesser-used *dBASE* features like Set View and Query, *dBXL*, Version 1.2, will run *dBASE III* code as is. Many small syntactical differences have been removed in Version 1.2, and most of the other features offer extended capabilities.

To add a new record to a database, for example, such commands as Append, Clear, Insert, Release, Replace, Store, and Use can all be used with the keyword AUTOMEM, which automatically initiates memory variables of fields already existing in the database. In a typical append sequence, Stor Auto initializes a complete set of memory variables with identical names, types, and lengths as the current database's fields. After data entry and quality checking, Append Auto can be entered in place of Append Blank and multiple Replace statements. This saves two blocks of code—replacing perhaps dozens of lines of code with one—and executes faster as well.

Another attractive compatibility is upward mobility to *Quicksilver*, Wordtech's compiler database program. (Except for interactive commands, these two programs are functional twins.) So *dBXL* programs compile smoothly in *Quicksilver*, and *Quicksilver* programs can be debugged interactively in *dBXL*.

EASY DOES IT *dBXL*'s manual succeeds in one volume where others fail in two. If you've never used *dBASE*, you'll appreciate *dBXL*'s beautifully written 80-page tutorial. The authors have created descriptions of commands and functions that are both concise and complete—no simple task. The programming examples are particularly instructive.

When getting started, you can Set Prompt to display the current drive, subdirectory, database, time, and/or date, instead of a bald "." prompt. The syntax used resembles DOS's Prompt command.

Intro is another handy start-up tool, especially for novices. Like the program itself, Intro is a superclone of *dBASE* Assistant, the user interface favored by many nonprogrammers. By following menu choices, you can accomplish all the basic tasks of managing a database. Neither, of course, is intended for power users. But unlike the Assistant, Intro *leads* you by anticipating your next likely step and presenting the appropriate menu.

dBXL's excellent help system works on several levels. You activate the general help menu (from the dot prompt) by pressing F1. Once you are inside built-in procedures like Intro, F1 summons procedure-specific information and also offers the general help menu. In a Get field, the "Help <charExp>" option enables you to specify a help message whose windowing characteristics are programmable.

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***dBXL Diamond Release*, Version 1.2**
Wordtech Systems Inc.
P.O. Box 1747
Orinda, CA 94563
(415) 254-0900
List Price: $199; LAN version, $599
Requires: 512K RAM, two disk drives (hard disk recommended), DOS 2.0 or later
In Short: A powerful "superclone" of *dBASE III Plus* that offers maximum compatibility plus true windowing, UDFs, arrays, and graphs. It is faster than *dBASE III Plus* but slower than *FoxBase Plus* 2.0. A fine value. Not copy protected.

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WINDOWS AND OTHER GOODIES *dBXL*'s smart modern look surpasses its competition both in its on-line user interface and in the programming tools it provides. Wordtech's windowing technology (which is also present in *Quicksilver*) makes it easy to create vivid, ultramodern displays and menus.

The program also supports multidimensional arrays, so if your brain is up to it, you can Dimension an array with a <num-Exp list> containing up to 255 numeric expressions or dimensions. While *dBASE* can simulate arrays with the &macro, true arrays are easier to work with and faster to process.

■ With a graphic monitor, *dBXL*'s Graph Form can make your data come alive.

Another unusual feature is Export Ventura—*dBXL*'s link to desktop publishing, designed for such uses as merging names and other personal information into direct-mail letters. This command creates a text file from selected DBF fields, automatically including the tag names required for *Ventura Publisher* merge printing.

With a graphic monitor, *dBXL*'s Graph Form can make your data come alive in bar, line, or step graphs, pie charts, scatterplots, or regression lines. Titles and footers can be defined, and both *x*- and *y*-axes can be labeled. The rectangular graphs can be univariant or bivariant, and you can enter up to five *y* values for each *x*.

Graph files are created through an uncomplicated definition screen rather like *dBASE*'s Modify Report. The inevitable trade-off is that, like Intro, the system lacks versatility and power; for example, scaling is not adjustable, and only 20 records can be processed at once.

Output can be displayed to all or part of the screen or sent to printers emulating the IBM Proprinter, Epson FX, or Hewlett-Packard LaserJet. Three disk formats are available: .BIT for retrieval with Restore Graph, .IMG for *Ventura*, and .PCX for *PC Paintbrush* or *PageMaker*.

Besides pioneering new concepts, Wordtech has also kept up with the Joneses. Valid, For . . . Next, and user-defined functions—all of which are among *Clipper*'s and *FoxBase*'s best selling points—are all implemented here as well. Unfortunately, Wordtech has not included *Clipper*'s wonderful Menu To command for creating timesaving *Lotus 1-2-3*–type menus; windows can be used instead, but at the expense of speed.

COMPETING FOR SPEED *dBXL* outperformed *Quicksilver* in several of the PC Labs benchmark tests. Append From Delimited, Sort, and Copy To commands all executed more quickly in *dBXL*; indexing and screen manipulation lagged behind *Quicksilver*.

But *dBXL*'s occasional speed advantage should not be surprising. New versions of Wordtech's interpreter and compiler programs have been leapfrogging each other for years, and the *dBXL* we tested is 3 months newer than our *Quicksilver* version.

Software designers face the challenge of making their programs easy for beginners, useful for intermediates, and sophisticated for experts. And they've got to run fast and be frugal with memory and disk space. Wordtech has struck a remarkable balance with much to offer all three classes: at $199, *dBXL* is a premium product at a bargain price.—**Brad Stark**

D the data language

D the data language, from Caltex Software, is a lot like one of those superfast Japanese trains you always read about: the design is unfamiliar, but can it move!

D is a programmable, relational database manager that organizes information using an English-like programming language and several different types of organizational interfaces. Priced at $395, it has a copious context-sensitive help system, including numerous sample files (which come on a separate floppy disk and can be eliminated to save disk space) and one of the best tutorial manuals I've seen in years.

To organize data, *D* uses the concept of the "collection." Each collection (labeled with the letters *A* through *E*) contains an isolated group of data from the main database that can then be worked with through *D*'s command structure. For example, to work with all members of the Employee field in the PC data group who earn over $50,000 a year, type "Find a PC where employee > 50,000." Once you've chosen your data, you can exhibit it in various ways; typing "Print A", together with the fields you want to print, shows the data on-screen; preceding it with a "PON" (printer on) gets you a printout. In addition, a Read command brings up the input screen for each individual record. You can refine these screens to include selected fields and follow specified field criteria.

The product indexes on key fields; if any type of search operation is to be done on a field, it must be declared a key field. While you can key any and all fields in a data group, doing so will take up quite a bit of room on your hard disk. There are a couple of ways around this: the Destruct command will eliminate any keyed field that is no longer necessary; in addition, you can specify the approximate number of unique values in a field to save disk space.

But once the one-time keying operation is over, *D* enthusiastically zooms through sorts, finds, and other operations. For example, during the PC Labs tests, it took about 21 minutes to key a couple of fields the first time they were needed for a two-field search. Once they were keyed, it took about 7 seconds to search through 50,000

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D the data language, **Version 2.6**
Caltex Software Inc.
3131 Turtle Creek Blvd.
Dallas, TX 75219
(214) 522-9840
List Price: $395
Requires: 512K RAM, hard disk drive, DOS 2.0 or later.
In Short: This speedy programmable relational database includes a simple proprietary language and a fairly friendly user interface. Not copy protected.

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records. This is where *D* really shines: the program speeds through large file operations without even breathing hard.

FOR NOVICES AND PROS A very flexible program, *D* lets you manipulate data either manually or through automated procedures; the same simple commands apply whether you need to organize data quickly using the command line or write a program to produce a complex report. The relational properties of *D* are activated through two commands, Match and Relate, which connect data groups through related fields. While nonprogrammers will find it a simple matter to create a basic procedure to produce a report, programmers will find the package suitable for creating more-sophisticated programs that use variables, mathematical structures, and more-involved output formats.

Novices will find *D*'s English-language interface a breeze to use, but it will take them more time to get used to splitting up the database format among such areas as Personal Interfaces, Procedures, and Reports. You define each of these separately using *D*'s built-in editor. Each uses *D*'s programming language to perform a different task in the definition of a database. And each is accessed through a Define menu, which places you in the appropriate editing area.

The Data Base Definition (DBD) is the rock on which the edifice is built: all fields are initially listed here, along with such criteria as size and whether or not they are keyed. Each group of fields is called a datagroup, and there can be several of these groups per DBD.

A Personal Interface (PI) is a different way to access a database; it is connected to a DBD, so that when you open a PI, you are simultaneously opening the DBD connected to it. PIs offer more control over the database. By using a PI, a programmer can limit the number of fields available to a user. You can gain even more control over your database by defining menus, which you create by simply "painting" them (using the editor) and marking menu selections with the F5 function key. You can embellish the menus somewhat by using simple line-drawing facilities and a Color command.

The most powerful part of *D*, though, is its use of Procedures and Reports. Procedures define the manner in which data is organized and include most sorting and selecting operations. From a Procedure, you can direct the program to go to a Report definition, which further refines the data and prepares it for output. These two functions are used to organize most applications, from small numerical operations to complicated reports. Once you become accustomed to *D*'s organization and language, you can put together sophisticated program applications relatively easily.

HANDY FEATURES Several other features, which at first may seem insignificant, make life a lot easier. For example, if you find a bug in your newly created program, typing Redef at the command prompt brings you immediately back to your last editing screen. In addition, *D* buffers everything that occurs during a session, enabling you to scroll up to review your past actions. You can also cursor up your screen prompt to copy a previously used command sequence.

Although its programming language is relatively simple, make no mistake: *D the data language* is not a package to be learned overnight. But it is certainly within the reach of users who have no programming experience. That, and its incredible speed, would make it an excellent choice for business users who want to create personalized database systems.

—Barbara Krasnoff

filePro 16 Plus

The manual furnished with *filePro 16 Plus*, from The Small Computer Company, describes it as both a database and an application development tool. Careful examination of *filePro* reveals a $990 program with two facets: one for anyone requiring carefully validated data input without programming and another for the developer of vertical-market software who wants transportability over several operating systems. Unfortunately, the same manual handicaps *filePro* by treating its commands too casually and gives little guidance to either the novice or the advanced programmer.

filePro provides extensive data entry validations, called *edits*, ensuring accuracy during data input. A typical edit with error message is written as: "Please enter only (Y)ES or (N)O" "Y"<ES>"N"<O>. Predefined global edits convert input to all upper- or lowercase, validate state abbreviations, format phone or Social Security numbers, and translate numbers to words for check writing. Unlike the case with many other databases, edits are not assigned to a single field but are assignable throughout the system.

Lookups into other files are easily created, though once the lookup itself is made, anything further requires programming. There is no automatic field replacement from the related record to assist the nonprogrammer. Also awkward is the requirement to replace fields with variable names in multifile screens and reports. *filePro* is relational, but only fields belonging to the primary file may be explicitly named; all others must be swapped in and out of variables.

Problems caused by the manual surfaced during the import and export phases of our benchmark-testing. After several failed attempts in which I scrupulously followed the manual's data import procedure, I called for help. That problem was caused by incorrect information in the manual pertaining to the import procedure and required file format; .SDF files actually require no import and may be used directly as "non-*filePro*" files. I could not get *filePro* to export to any disk drive other than

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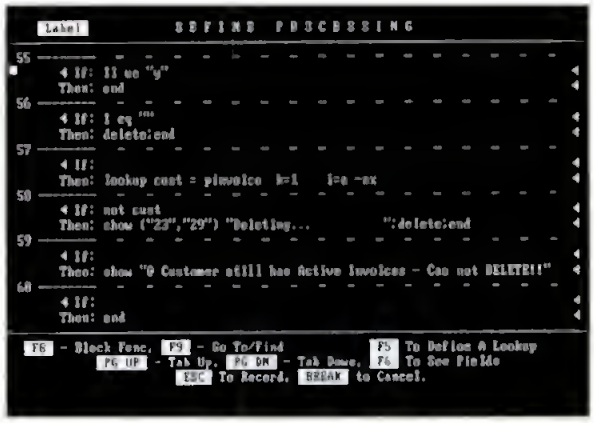
filePro 16 Plus, Version 1.01
The Small Computer Company Inc.
41 Saw Mill River Rd.
Hawthorne, NY 10532
(800) 847-4740
(914) 769-3160

List Price: $990
Requires: 384K RAM, hard disk drive, DOS 2.0 or later.
In Short: Inadequate documentation and unusual features handicap what might otherwise be a productive database manager for programmer and nonprogrammer alike. Not copy protected.

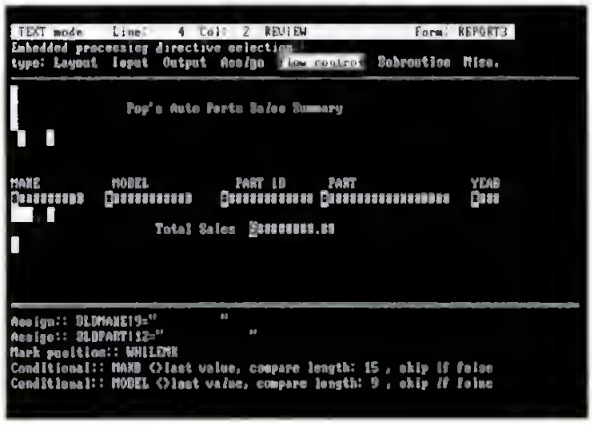
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By hitting F1 after you've typed in a command in **D the data language,** *you activate a split-screen help feature. You can continue to work on the upper screen while the help file remains or remove the help file with the Esc key.*



The command language of **filePro 16 Plus** *is easy to use once you become comfortable with the strict If-Then-Else formatting. Commands that require no tests are entered on the Then line. Line 57 commands an exact-match lookup into key field #1 of the Pinvoice file using index file* a.



Formula IV*'s program creation module uses prompts to guide the user through a logic statement. Five statements at a time are visible in the window at the bottom.*



FoxBase Plus *delivers a Report Writer with an interface nearly identical to that of the old* dBASE III *Report Generator.*

the default—a bug in both the program and the manual—so the test times reflect writes to a hard disk instead of a RAMdrive.

filePro assigns automatically maintained indexes for up to eight individual fields or creates demand indexes on up to ten combinations of eight fields each. Any change to the data included in a demand index invalidates it, but *filePro* gives no indication when this occurs. Even though *filePro* permits combinations of fields in demand indexes, it cannot perform an indexed search on more than one field at a time. The fast retrieval times in the benchmark tests reflect my prior knowledge of the search criteria at index creation. Unless you know what you are looking for, the index locates only the first field; to find the rest you'll have to browse through the file. You can still use the standard single- or multiple-field searches, but these are record-by-record passes through the file.

AWARD-WINNING MANUAL? The shrink-wrap covering the *filePro* manual carries a sticker touting the "award-winning" contents. The pages are well designed, with sufficient white space and good typesetting and printing; however, the content is sorely lacking in accuracy and in relevance both to the product and to the needs of its purchasers. This loose-leaf book repeatedly leaves a topic unfinished as it moves on to the next.

The separate wire-bound tutorial refers to an earlier *filePro* version, and the examples given for menu creation do not function when entered as described. A tutorial should leave one with at least rudimentary

working knowledge of a product; *filePro*'s tutorial left me confused and wishing for another manual that described the program better.

The lack of complete, relevant programming examples stymied my attempts to perform the benchmark-test procedures without help from tech support. It's no wonder that The Small Computer Company offers beginning and intermediate classes.

Profile, *filePro*'s ancestor, dates back to the early Radio Shack TRS-80 days of personal computing. *filePro* currently holds a large share of the UNIX/Xenix database market, and several vendors offer *filePro* vertical-market packages for UNIX and DOS. Such programs include accounting, doctor's office management, and real estate closing systems, among many others.

The potential for productivity is obvious from the minimal programming necessary to perform most tasks. The stumbling block is the manual. Until it accurately represents the program and includes sample programs, plus guidance for the nonprogrammer, users will pay a heavy price in time and money trying to understand what *filePro 16 Plus* can do for them.

—Michael Friedlander

Formula IV

Formula IV is a golden oldie among database packages, one that's currently available in single- and multiuser, network and runtime versions. Its developers at Dynamic Microprocessor Associates continue to add unusual power features like control of the communications ports and print spoolers for the multiuser version. A *Formula IV* database can take input from an electronic clock or send output to an alarm. In fact, few applications are beyond the reach of this $395 package.

Formula IV's menus and screens sport essentially the same look that characterized its original incarnation nearly 10 years ago. One primary menu presents a list of essential program modules. A User's Guide teaches basic use of the modules by detailing the steps in a complete, simple one-file application. At this level, both the program and its documentation are clear and accessible to most users.

Multifile applications and those employing *Formula IV*'s power features require a long jump into the more-technical documentation of the Reference Guide. This material details well the functions of each module, with explanations of parameters, options, and keywords along with tips and warnings about their use. Though very informative, it is clearly intended for knowledgeable applications designers. (Note, though, that DMA uses the term "DIF" in its older, generic sense, equivalent here to "delimited ASCII.")

FILE DEFINITION AND QUERY Creation of a *Formula IV* database begins with a simple fill-in form to define a file. The definition includes up to four one- or two-field primary indexes that are automatically maintained thereafter, although at any point they may be altered.

Default provisions for data entry and maintenance use descriptive prompts from the file definition. Record selection is by record number or by any primary index. Both of these modules are very easy to use, and the context-sensitive help screens clarify such choices as field type.

A Query module provides the simplest form of output, but its considerably wider range of choices renders the user interface more complex. *Formula IV* queries are English-like phrases written on an editing screen. Here the help screens are even more useful, although they cover only keywords and concepts—not, for example, lists of available file or field names.

What is particularly interesting about the Query language is that most of its keywords have several alternatives, and the order of significant phrases doesn't matter. It's left to you, then, to find a format that's pleasing for you. In addition, you may expand the system Query dictionary to incorporate any other terms for the keywords or for any part of a Query sentence.

The Query language incorporates such functions as output to an external device, various sorts of formatting, compound Boolean selection criteria, and on-the-spot indexing. One especially nice touch is an output option called Ask that lets you designate your desired device at runtime. The only overall drawback of the Query module is its restriction to a single file at a time.

FORMDEF For multiple-file output, custom-designed input, and just about anything else an applications designer's heart desires, *Formula IV* provides the Formdef module. Programming actually occurs here, and a host of available options includes extensive mathematical and string manipulation functions, one-dimensional arrays, abnormal termination options, subroutines, and direct access to hardware drivers. A last-value conditional simplifies the identification of control breaks, and embedded ASCII functions can take advantage of all IBM screen control sequences, including color.

Any program may access up to 12 files. One designation can activate all four primary indexes, and the system continuously maintains separate pointers in each, permitting unlimited movement among retrieval sequences. You can also use one file several times for additional indexes and even more-complex switching. File opening and closing are automatic.

The user interface for the Formdef module is unusual. You start by entering options such as file use with a fill-in form, then move to a three-part screen for the bulk of the work. The center, a full-screen editor (but without block-move capability), is for creating specific input or output forms almost as they will finally appear; I say *almost* because of the displacement effect of inverse blocks. Indicating the pres-

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***Formula IV*, Version 1.19**
Dynamic Microprocessor Associates Inc
545 Fifth Ave.
New York, NY 10017
(212) 687-7115
List Price: Single-user version, $395, multiuser version $695, network version, $695; runtime version, $50.
Requires: 256K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: A flexible package with unusual multiuser features. *Formula IV* has strengths that are more attractive to the applications developer than to the average business user. Not copy protected

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Quick–turn the page.

ence of embedded statements, these control everything from record selection to looping instructions.

You insert inverse blocks at appropriate positions in the form by toggling to a small logic window at the bottom of the screen, then selecting appropriate functions from a bar menu. The resulting statements appear in the logic window whenever the cursor is on the appropriate block in the central form.

Such atypical means of programming take some getting used to, especially for complicated tasks. The "skip if false" format of conditionals actually accommodates any option, for instance, but the mental gymnastics of the double negative are taxing in these days of unrestricted if-then-else constructs. DMA accurately estimates that most people need at least 3 weeks to master the package.

SPECIAL FUNCTIONS Additional *Formula IV* modules perform various special functions. The Update module permits automatic batch updating of any file with data from any other file, including external delimited ASCII or undelimited fixed-field files (great for people who are working with data from a mainframe). The Index module will build and combine any number of extra indexes. Other modules create menus to run simple or complex jobstreams, provide access to DOS, supply password protection, and accomplish various housekeeping functions.

Formula IV calls itself "The Application Creator," and it is clearly oriented toward the development of total applications rather than individual interactive operations. Consequently, automatic features such as file unions, time arithmetic, report footers, and the Boolean NOT, which are fairly common among current database products, are absent from *Formula IV* as specific named commands. Programs can accomplish the same result, with the exception of the physical sort. While the term *sort* appears as a menu choice, only index files are actually sorted. Physical data records remain in their original order, although you can manipulate them in any sequence you choose.

Formula IV's real strength lies in the flexibility it puts in a designer's hands, but tapping its resources may test your skills. The PC Labs benchmark-test report that prints a combination of ascending, descending, and ascending alphanumeric fields, for instance, required fancy workarounds because *Formula IV* indexes are always ascending. Conversely, certain complex functions—like updating one file with information from another—are a cinch here.

In the end, however, only the imagination of the programmer significantly limits *Formula IV* applications. The package bears a resemblance to certain all-terrain vehicles. It may sometimes require effort on the part of the driver, but there are few places it can't go.—**Joy Segall**

FoxBase Plus

FoxBase Plus, Version 2.0, from Fox Software, is a $395 fully compatible replacement for *dBASE III Plus*. Designed to meet and exceed the needs of *dBASE* users, *FoxBase Plus* is wonderfully fast (up to six times as fast as *dBASE*), with all of the features demanded by the *dBASE* applications developer.

While novices will find *FoxBase Plus* a treat to use, it has fewer bells and whistles and more of the real power required by experienced *dBASE* users. This includes a number of extensions to the *dBASE* programming language. And though it's no more of a true relational database than *dBASE* is, every *dBASE* user should give *FoxBase Plus* serious consideration.

NO FRILLS Everything about *FoxBase* struck me as lean, stripped of frills, and equipped to perform in a high-powered fashion. The manual is simple, direct, and well organized. The few *dBASE* commands that are not supported are not hidden away but listed right up front, next to the substantial list of enhancements to the language.

After a simple installation process, you're ready to go. The *dBASE III Plus* programs I used to generate the timing tests ran under *FoxBase Plus* without a single modification. Databases created with *dBASE* were used without change; there is no need to use a conversion program. *FoxBase Plus* can even read *dBASE II* files and convert them to the *FoxBase* format via the *FoxBase* command. While *FoxBase* gives you the option of using either *dBASE* or *FoxBase* index formats, I suggest that you let it rebuild your index files for you: they'll usually be less than half of their original size, and the reindexing is exceptionally fast.

What's the reason for the package's speed? *FoxBase Plus* keeps as many files and database objects in memory at one time as possible. It's not a RAM-hog: extra memory is used only when it is available. In addition, LIM EMS memory usage is supported automatically.

FoxBase's developers have paid careful attention to avoiding a problem inherent in *dBASE III Plus:* a lack of unity. Rather than reinventing the wheel, they invested the time to choose the best algorithms to do the job, thought about how these should work together, and implemented them accordingly.

The few *dBASE* commands that are not implemented in the current version of *FoxBase* include Catalog, Import/Export, Create/Modify/Set Query, and Create/Modify Screen. Support for Views will be available in Version 2.1, as will Assist, which is written in compiled *FoxBase*.

THOUGHTFUL EXTENSIONS The extensions to the *dBASE* language include a number of thoughtful features that the experienced *dBASE* user or applications de-

EDITOR'S CHOICE

PC MAGAZINE FACT FILE



***FoxBase Plus*, Version 2.0**
Fox Software Inc.
118 W. South Boundary
Perrysburg, OH 43551
(419) 874-0162
List Price: $395; multiuser version, $595; *FoxBase Plus/386*, $595.
Requires: 360K RAM, hard disk, DOS 2.0 or later; multiuser version, DOS 3.1 or later.
In Short: Considerably faster than *dBASE III Plus*, *FoxBase Plus* is a lean, high-powered performer with a number of extensions to the *dBASE* programming language that will be of special interest to experienced *dBASE* programmers and applications developers. Not copy protected.

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Lotus Graphwriter II

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veloper will find useful. One of these, user-defined functions (UDFs), allows developers to extend the language indefinitely to fit their own needs. UDFs can include any valid *FoxBase* statement and can be used with memory variables, in control statements, and in commands such as List/Display. Used with the *FoxBase* "@ . . . get . . . Valid" statement, UDFs can perform extensive end-user data entry validation.

Another addition, memory variable arrays, is sorely lacking from traditional implementations of the *dBASE* language. In *FoxBase Plus*, they allow a program to create one- or two-dimensional arrays of up to 3,600 elements each. Included are simple array initialization commands and commands to move database records to and from an array in a single step.

Other *FoxBase Plus* features that are not found in *dBASE III Plus* also focus on the *dBASE* programming language. For instance, a simple command will allow multiple database relations per file (*dBASE* can have only one per file). Up to 128 procedures can be bound into a Procedure file (only 32 in *dBASE*). Forty-eight files can be opened simultaneously (*dBASE*, like DOS, is limited to 15 files open per process). In addition, the user or a program can control the DOS Critical Error Handler from *FoxBase*. For example, print programs won't grind to a halt when the printer is off-line, and you don't have to see the dreaded "Abort, Retry, Ignore" message.

An 80386 protect-mode version of *FoxBase Plus* takes advantage of the 386's virtual memory capacity. A look at a beta release of Version 2.1, which should be available soon, revealed a number of additional enhancements, including program support for horizontal and pop-up menus, windowlike screen scrolling, and a DOS filename search capability.

In fact, the Assist program packaged with Version 2.1 is written in *FoxBase* and sports some of the menuing features that will be available to *FoxBase* programs. The smartness and snappiness provided by these new features will let your *FoxBase Plus* applications put a lot of compiled language programs to shame.

FoxBase Plus, Version 2.0, is an excellent micro-based DBMS for users who want to retain complete compatibility with an industry standard, *dBASE III Plus*, while gaining increased speed and additional capabilities. Although it won't hold your hand through the novice stage, anyone who wants to use the *dBASE* database language should take *FoxBase* out for a test drive.—**Richard Hale Shaw**

KnowledgeMan/2

Calling all CPUs. Wanted, for first-degree data management: *KnowledgeMan/2*, a.k.a. *KMan/2*. Be on the lookout for its powerful features but flawed support design. Consider it armed, and do not attempt to apprehend it without assistance unless you know what you are doing.

No, *KMan/2* is not a subversive or criminal element, but you may well develop a love/hate relationship with this $595 package. It was developed by mdbs (Micro Data Base Systems) of Lafayette, Indiana, which also publishes one of the most powerful micro database development tools, *MDBS III*. Both products lay claim to a genealogy based in sophisticated minicomputer database management systems.

At the heart of *KMan/2* lies a command language, much like that of *dBASE*. This interpretive language uses procedure files written as standard text files. You can write procedures that call other procedures, use familiar programming commands like If-Then-Else or While-Endwhile, and use memory variables to pass parameters back and forth between program modules.

A number of extra features make *KMan/2* shine. For example, you'll find it extremely easy to link multiple tables on the fly; they only need to have fields in common and be indexed on those fields. You can then report on fields from all the tables at once, with selection criteria, ad hoc sorting, and subgrouping, all from a single command.

KMan/2 also offers some features that are either options or unavailable in other programs. For example, not only does it offer dimensioned array memory variables, but they can be either one- or two-dimensional arrays. This may appear to be a fairly obscure feature, but if you have ever tried to program an application that required arrays with a language that did not support them, you can appreciate the importance of such sophistication.

In fact, *KMan/2* seems to revel in the obscure. There are 59 separate "Environmental Variables" that let you control such minute details as whether the screen or printer pauses before scrolling to the next page, whether the standard deviation is listed at the end of a Select statement, whether records marked for deletion are to be included in normal processing, and even what the wildcard match characters are to be.

POWER (AT A PRICE) All this power pays off. For example, the complex report required for the PC Labs benchmark testing can be written and executed in a single line, provided that a few of the environmental variables are set appropriately. In fact, there is not much that you cannot do with *KMan/2*, right down to full-featured custom applications.

The power comes at a price, however. This program is not easy to learn. In fact, it's a bear. The manuals—especially the tables—are printed in a dense, small type. The organization of the documentation shows significant effort but falls somewhat short of the mark. The installation section of the user manual, which is designed for novices, instructs you to press Enter, but later on the same page says press FEnter. *KMan/2* has its own nomenclature for referring to keys, such as Fabort, FStart, and FZap, instead of the more typical Esc,

PC MAGAZINE FACT FILE

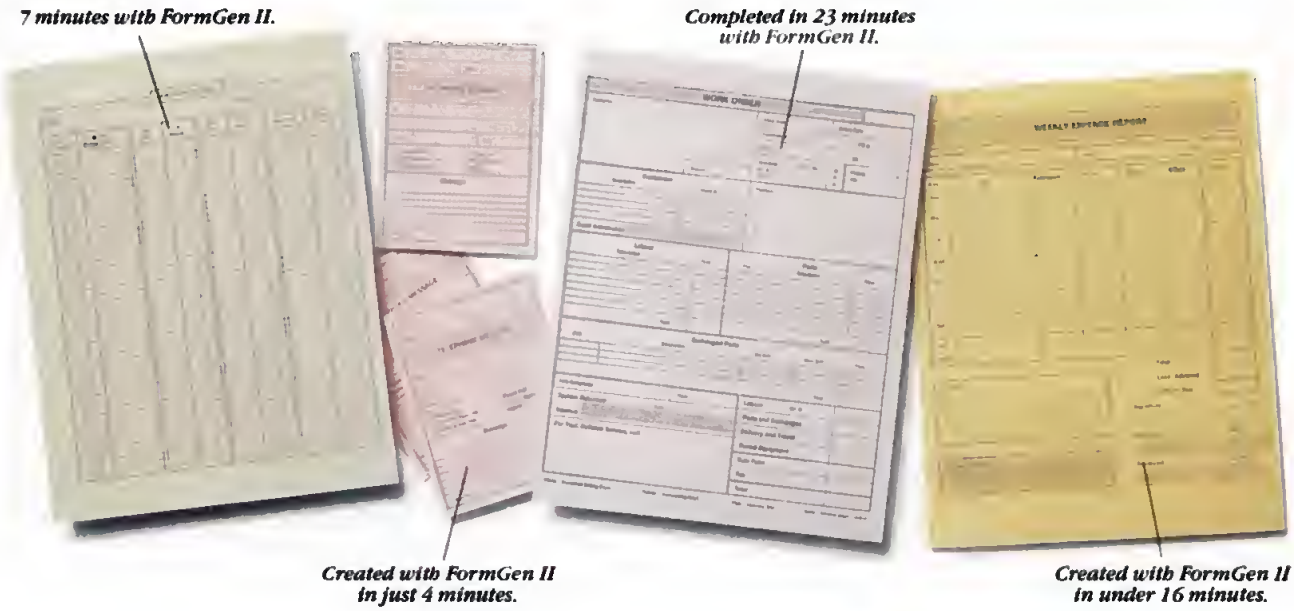


***KnowledgeMan/2*, Version 2.01**
mdbs Inc.
P.O. Box 248
Lafayette, IN 47902
(800) 344-5832
(317) 447-1122
List Price: $595

Requires: 512K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: Powerful and full-featured, *KnowledgeMan/2* requires more effort from the user than most novices are willing to invest, making it best suited to users who design complete custom applications. Not copy protected.

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Home, and Backspace. Renaming keys does not appear to be a way to help novices.

KMan/2's reference manual explains each command as many as three separate times on successive pages, each time adding more detail. Each section does include examples of proper syntax, but examples of the commands' results are rare. The manuals include indexes, which are only fair at providing references to topics. For example, the entry for *array* says "(see variable array)," but there is no corresponding entry.

But mdbs does provide numerous assistance features. There is a menu-driven front end to the program, with its own help screens. Unfortunately, this system is of little use, since it does not do much to guide you or keep you from making mistakes. For example, when trying to create the sample table structures for the PC Labs benchmark tests, I was prevented from completing the process three times. Each time, a slightly different error message flashed briefly at the bottom of the screen, providing little information that would help a puzzled novice.

I found it far easier to enter *KMan/2* 's command mode, where the error trapping was more immediate and informative and where the help screen system is more useful. Not only does this mode include a table of contents, but it lets you branch to topics of importance.

A MULTITUDE OF MODULES A number of other features make the program more versatile. One item, a spreadsheet, comes bundled with the product. Because it's slow and cumbersome to use, it will be of limited interest to most users. The other features are all optional. K-Chat (natural language interface), K-Comm (communications), K-Report (report generator), K-Graph (graphics), K-Text (text editor), K-Paint (data entry screen editor), K-Mouse (mouse support and menus), and K-C (functions to access *KMan/2* tables from C programs) currently add about $1,700 to the cost of a complete system, but this will change with the next release of the package. Starting with Version 2.5, *KMan/2* will cost $695, including these optional modules. These will significantly enhance the value of the package.

With its raft of tools, *KnowledgeMan/2*'s home is with applications developers and other users who want to create full-blown custom applications. The program is powerful, without question, and makes it relatively easy to perform some complex tasks. This power does not come in a form that novice users will find very accessible, however, and some experienced users will prefer a package that comes with wider third-party support and the faster execution of a compiler.
—Alfred Poor

Magic PC

Magic PC, a $199 visual database applications development system from Aker Corp., does away with conventional database programming techniques. In the overall scheme of Project Database 3, it is a programmable relational DBMS. But it remains significantly different from other DBMS packages in this category.

Although *Magic PC* is programmable, it does not include a conventional programming language. Nor is it an applications generator; it doesn't generate code to be interpreted or compiled. Only through developing an application does the program provide a means of manipulating a database.

Magic PC is actually a database engine. It processes a database according to a set of rules defined by the developer, generating screens, reports, and other files. Instead of programming an application, a developer specifies it. The database engine is written in Microsoft Pascal; it uses *Btrieve* as the file manager.

FILLING IN TABLES Developing an application with *Magic PC* consists primarily of filling in tables. Three general types of tables make up an application: database file definition tables, task execution tables, and menu tables. Of the three, a task execution table looks most like a DBMS program, but it is actually a nonprocedural specification of a data view (the group of fields used to execute a particular task) and the manipulations to be performed on that view. Both the data view and manipulations are specified with a total of 13 operations, which replace the scores of keywords found in other less-streamlined data manipulation languages.

Most applications also require screens and reports. *Magic PC* incorporates a screen editor, which is used to design screens, printed reports, and external file formats. Again, creating screens and reports does not involve generating code but simply specifying them with the screen editor.

Windows are intrinsic to *Magic PC*, for both the applications developer and the end user. They're easily defined with the screen editor, the same one used to create main screens and reports, and often are displayed by optional subtasks with the Zoom key (F5).

The tools that comprise *Magic PC* make extensive use of function keys and point-and-shoot menus. Table entries are typically made by zooming to an option table, selecting an option, and pasting the option with a function key. Most of your actual typing consists of entering labels—file names, menu text, and so on—and expressions that are used to calculate numeric results and process data. Numbers, of course, must be typed to indicate the length of fields.

Magic PC is a relational database manager. A *Magic PC* database consists of up to 999 *Btrieve* data files, or tables. The definitions of all data files in a database are contained in a single *Btrieve* data file, so that data files can be created—and recreat-

PC MAGAZINE FACT FILE



***Magic PC*, Version 2.36**
Aker Corp.
18007 Skypark Circle,
Suite B2
Irvine, CA 92714
(800) 345-6244
(714) 250-1718
List Price: $199

Requires: 512K RAM, hard disk, DOS 2.0 or later.

In Short: Rather than using a conventional database programming language, *Magic PC* has a database engine that reduces applications development time dramatically, without sacrificing either the power of the relational model or the speed of execution. Not copy protected

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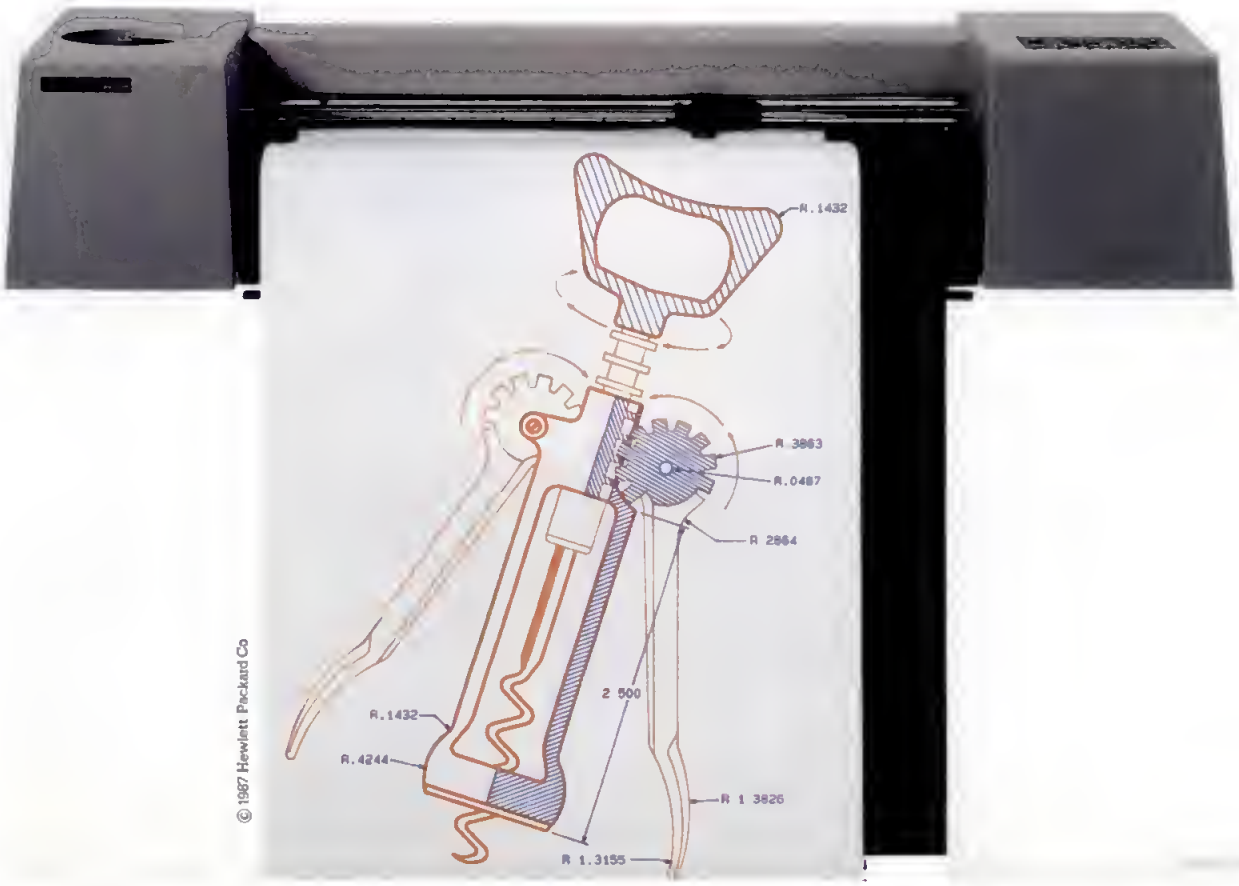
HEWLETT PACKARD

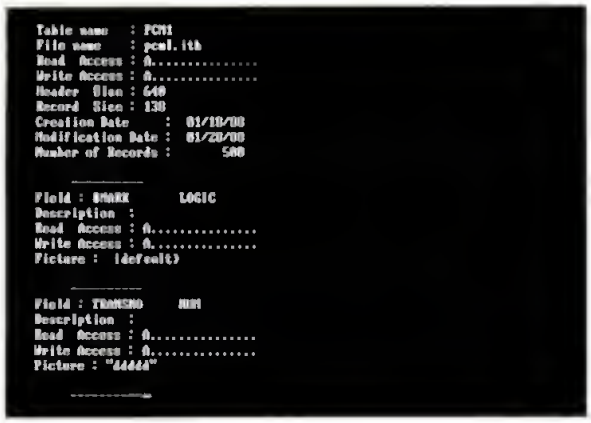
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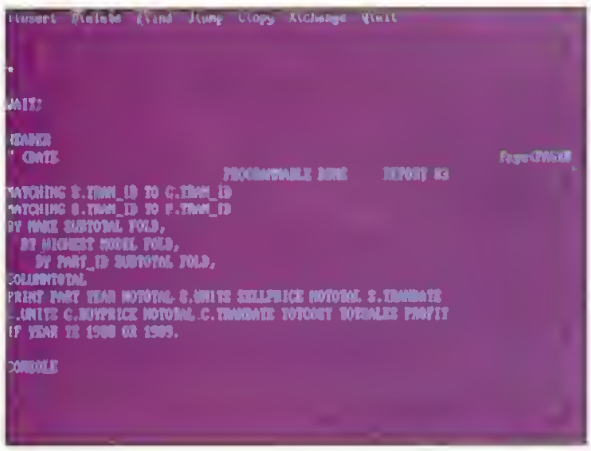




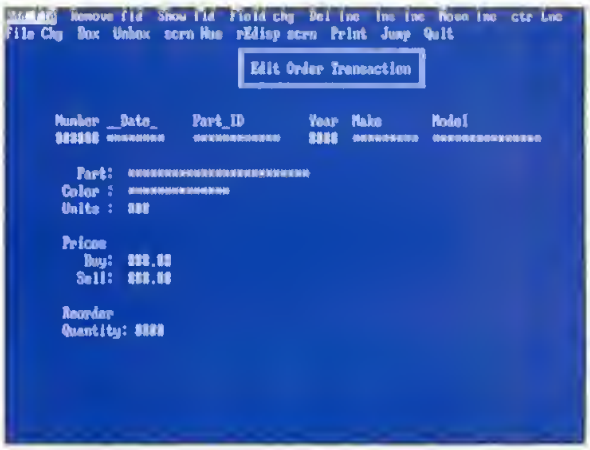
The Show (table) command lists the structure and fields of a **KnowledgeMan/2** *table. The first field is always #MARK, and its entry is True if the field is marked for deletion. Note that password protection may be assigned at different levels to individual fields.*



The Task Definition screen is the heart of **Magic PC***'s visual programming methodology. The Operations table lists the 13 operations that replace the scores of keywords in other systems.*



This .EXC report request illustrates the power and conciseness of **NPL/R***'s programming language. The report links three seporate databases: S = Sales, C = Cost, and P = Product. It also creates various subtotals and column totals, and you can ask it to extract only those records where the year field = 1988 or 1989.*



The O'Hanlon Database Solution *features a screen used for "painting" data entry screens. Using a* 1-2-3*–like menu at the top of the screen, you can create data files and individual entry fields, enter screen captions, draw boxes, change screen colors, and jump to another entry screen.*

ed if they are lost—automatically.

Each data file incorporates up to 24 keys, each of which can consist of up to ten segments. Indexing is automatic; *Btrieve* maintains an index in the data file. To reindex, you modify the data file definition via the data dictionary screen and then invoke a Convert utility.

Data files are typically linked to form the relational database via equal values in identical fields. *Magic PC* differs from most relational data managers in that these links are not statically defined in the data dictionary. Instead, they are defined dynamically in the task execution tables.

In fact, *Magic PC* can establish a link based on data contained in dissimilar fields, or even on computations; the only requirement is to derive equal data values in the two linked files. While a link exists, the linked file is effectively an extension of the main file.

In its implementation of the relational model, *Magic PC* supports three types of relationships: one-to-many, many-to-one, and many-to-many. This capability facilitates the development of applications that incorporate multilevel reports and scrolling multiline screens.

WHAT MAKES A GOOD "MAGICIAN"?

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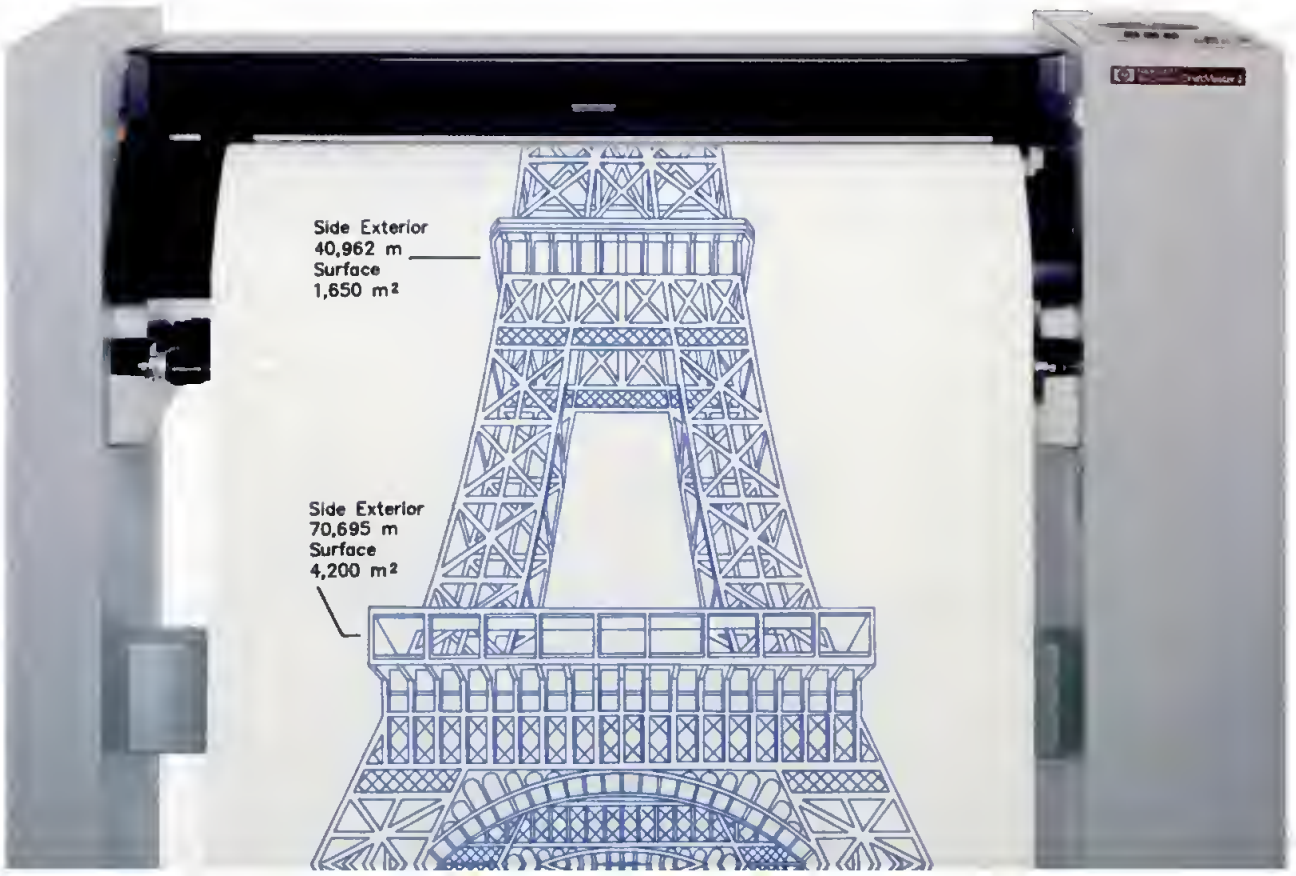
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CIRCLE 215 ON READER SERVICE CARD

how a mere 13 operations can replace complex data manipulation languages. But "Magicians" (developers converted from other packages) welcome the concept of operations.

For one thing, there is no operation to open or close a data file. Everyone knows that a file must be opened before it can be used and should be closed as soon as possible thereafter. So why not make opening and closing of data files automatic? That's what *Magic PC* does, eliminating a number of keywords or commands.

When a task is invoked, it opens the appropriate files. When the task is complete, the files are closed. Other tasks are handled in the same manner. Mundane chores are handled automatically, so that the developer can concentrate on high-level operations.

The 13 operations provided are sufficient to define data views, establish relationships between tables, execute subtasks and external programs, read and write external files, structure applications into blocks, and produce complex reports.

Some applications developers demand absolute control over their products and seem willing to go to any length to create their vision of the perfect package. Others prefer to crank out the applications as quickly as possible and are willing to invest time and money to create or acquire the appropriate tools. *Magic PC* is more suited to the latter sort.

To use *Magic PC* effectively, you must think in terms of specifying an application rather than coding it or even tuning code generated automatically. This is too great a philosophical leap for some developers, particularly for those who insist they control every detail of an application.

But even nonprofessionals can use the program effectively without learning a programming language, *if* they first learn the principles of database management. The *Magic PC* package includes a sample application—and a tutorial in the manual that guides you through the project of extending that application. The tutorial covers every feature and leads you through

BENCHMARK-TEST OBSTACLE *Magic PC* proved equal to all tasks in the PC Labs benchmark tests, but we encountered one difficulty in the ASCII record import. *Magic PC* requires a delimiter after each field in a record, including the last one. The benchmark-test ASCII data files do not include the final delimiter, as they conform to the Microsoft BASIC convention of delimiters between fields. Once the final delimiters were added, the files were imported without further difficulty.

None of the PC Labs benchmark tasks could be handled without writing some sort of application, at least to define the data view. However, few of the tasks required more than a dozen operations, including the data view definition, and few took more than 15 minutes to write and test.

Overall, *Magic PC* is one of the most-powerful DBMS packages available for the PC. In terms of file capacities and data manipulation capabilities, among other things, it is easily the equal of other packages in its category. The vendor, however, presents *Magic PC* not as a more-powerful data manager, but as a more-powerful development environment. And that it certainly is—a "Magician" can forget about code and concentrate directly on the system design.—**Victor E. Wright**

NPL/R

The first three letters of *NPL/R* ($595) once stood for *Non-Procedural Language*. Renamed, NPL now stands for *Non-Programmers Language*, but it seems NPL can't divest itself from procedures. In reality, NPL ought to stand for *Not-for-the-Pusillanimous Language*.

It's powerful. It has the potential to accomplish much in the hands of an astute database developer.

But *NPL/R* is "plain vanilla" power. It lacks a user-friendly interface, diverges from some established database programming conventions, lacks support for specialized hardware environments, and is fairly keystroke-intensive. Although it includes four separate documents, which are informative and well organized. These talk to you in terms simple enough for nonprogrammers to grasp, but in enough depth that commands can be used for nearly all they are worth.

Unfortunately, the small "Get Off to a Fast Start with *NPL/R* Plus" leaflet that documents the installation process gets you off to a rocky start. First of all, *NPL/R* replaces your CONFIG.SYS file with one of its own liking (including an ANSI.SYS

■ *NPL/R* has the potential to accomplish much in the hands of an astute database user. But it lacks a friendly interface.

command that needs a driver). It then renames your CONFIG.SYS file as CONFIG.BAT.

The program requires the presence of a keydisk when not installed on the hard drive, but even when on a hard drive it looks for floppy disk keys before booting (unless you change the default profile, not a task suited to a beginner). *NPL/R* is also crippled by having only 60 records available until an installation procedure is run.

With monitors, *NPL/R* takes advantage of color but not resolution, and there are no special printer configurations since all reports are ASCII dumps to the printer. These days, formatting a report attractively through a printer's features is as important as having it contain good data. *NPL/R* can't accommodate.

POWERFUL LANGUAGE The NPL language is undoubtedly powerful, with concise syntax the norm. Typing the single sentence "Write sales ave. commission by region by agent across product" produces

To some people, the difference is obvious.





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Throughout the program, simple keywords quickly do the job. A simple Print Over command solves the embarrassing problem of how to get an expensive database to create a mailing label. Join is NPL's powerful relational four-letter word. And NPL is forgiving about syntax, order, and capitalization. You also can insert all the commas, colons, and semicolons you like in order to improve the readability of your program.

While conceptually *NPL/R* is divided into a number of different modes based on functionally similar keywords, all commands are executed from a single CMD> prompt. More often than not, you'll enter a series of commands at the command prompt and invoke the stored program with a Do command. But when using the system interactively, the conceptual *NPL/R* model helps by lumping "like keywords" together.

NPL/R also provides a full-screen text editor, although you are permitted to use your own as well. The editor allows easy insertions, deletions, copies, and overstrikes of text, but is unable to work with marked blocks of text. You must work with the editor in an insert mode and signify completion by pressing Ctrl-A, which is a throwback to older program styles.

The Data Form mode lets you modify field attributes, but it's the Report mode that houses *NPL/R*'s relational, sorting, and matching power. Matching phrases include Exceeds, Is More Than, Not, To, Nor, If, Eq Or, and a host of others.

During benchmark testing, NPL programs were impressively brief and very fast; no program was more than a few lines long. But despite *NPL/R*'s speed and eloquence, it lacks the interactive elements that make PCs so well liked. To retrieve a file, for example, you type "Getfile *filename*" at the CMD> prompt. If successful in this task, the machine responds with another CMD> prompt. There's no feedback that says, "Yes! Your file has been retrieved." Your only recourse is to type "Files?" at the prompt and watch the contents as they scroll across the screen. To bring up a data screen, you must first Get the file, then type "Files?" to verify, and finally type "Modify Append" to see the first record. That last command, like many others in *NPL/R*, cannot be abbreviated.

I encountered other infelicities. The results of calculated fields cannot be displayed on-screen, nor will *NPL/R* accept import from variable-length files with comma delimiters. Both fixed-length ASCII and *dBASE* formats can be imported, and files may be converted to binary from ASCII.

BOTH SIDES NOW Much of *NPL/R* can be viewed as either good or bad. Because it is ASCII-based, for example, every component is open for inspection and modification. Every file is a text file, including the data dictionary. If you enjoy using a totally free development environment, you'll love it. If you take comfort when your data definitions are tucked away and when cryptic records increase security, you'll hate it. If you despise typing, you'll hate keywords such as Acrosstotals and Columntotals—which must be typed out—however English-like they are. A data field, at least, can be assigned an alias, but that's as far as it goes.

With its roots clearly planted in *Focus* and *Ramis* mainframe applications, *NPL/R* is one of those programs that are both old and exciting. One of the first programmable relational products for small computing machines, it is a model of what hybrid procedural/nonprocedural languages can do.

At the same time, *NPL/R*'s lack of network support, data encryption, and record locking makes it a poor choice for many environments. Also a drawback is its lack of help screens and menu-building tools. As it stands, *NPL/R* is a fourth-generation language with a second-generation user interface.—**Robin Raskin**

The O'Hanlon Database Solution

If you're looking for a quick tool for developing text-based business applications, *The O'Hanlon Database Solution*, Version 3.4, may be your solution as well. *O'Hanlon* ($650) is a programmable B-tree database structure for MS-DOS and other environments.

An optional set of companion tools ($460) allows you to develop polished applications with a minimum of effort. The programming utilities consist of MegaMenu, a menu control system; Help, which provides on-line help for your menus and also serves as user documentation; Security, a menu and file access control system; and Work Area, a tool for managing your development files.

Work Area, which manages files and

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***NPL/R*, Version 3.1**
Database Applications Inc.
400 Wall St.
Princeton, NJ 08540
(609) 924-2900
List Price: $595
Requires: 384K RAM, two disk drives or a hard disk, DOS 2.1 or later.
In Short: Divided into a number of different modes based on functionally similar keywords, *NPL/R* has a concise and powerful programming language capable of building sophisticated applications. Weaknesses are its lack of a user-friendly interface, help screens, and record-locking capabilities. Not copy protected.

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***The O'Hanlon Database Solution*, Version 3.4**
O'Hanlon Computer Systems Inc.
11058 Main St., #250
Bellevue, WA 98004
(206) 454-5350
List Price: Single-user, $650; multiuser, $995.
Requires: 128K RAM, hard disk, DOS 3.0 or later.
In Short: This program offers a straightforward relational approach to business programming. Its strengths are the menu-driven forms and report generator, data dictionary, and query facility. It lacks the ability to import ASCII files easily and does not have a sophisticated report writer. The availability of utilities and accounting source code is a plus for system designers. Not copy protected.

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directories related to a specific application, is one of the package's strong points. It has an archive feature, a global search-and-replace, and a loop program to allow multiple recompiles or multiple structures. This allows a developer to change parameters and compile a set of code that has a custom look and feel but the same core functions. Compiled code is transportable to different environments; only the runtime of *O'Hanlon* programs changes.

Installation is quick and easy. A menu-driven interface makes the system immediately useful to beginners and provides some powerful time-saving tools for even the most experienced programmers. You can create data entry programs in an easy three-step process: paint a screen, generate the program, and initialize your files.

PROGRAM CREATION An option on the main menu allows you to "Paint a Screen or Report Format." Painting gives you a full-screen editor with a *Lotus 1-2-3*–type "flash menu" at the top of the screen. You can create data files and individual entry fields, enter screen captions, draw boxes, change screen colors, and jump to another entry screen. This jump lets end users bring up another entry screen without leaving the current screen.

Once you're done painting the screen, you select one main-menu option to generate a program and another to initiate the data files. When you execute the program, before you appears the data entry screen with a flash menu at the bottom. You can include flash menus—complete with a help sentence—in your own programs.

Data dictionary listing and copying functions help you maintain control of variable names and usage in complex environments. In this respect *O'Hanlon* is more sophisticated than other systems I've seen.

To help you learn both program generation and program modification and creation, the documentation contains a long and thorough tutorial. An excellent code editor and debug facility work together to minimize the time it will take you to develop good code. Flash menus in the editor and trace debugger are consistent with screen- and report-generation features.

When you enter command structure in the code editor, you select the appropriate syntax from a flash menu. Once you select "IF" as the first part of a command, for example, you are presented only with the options that are still valid (goTO, goSUB, Else IF, Begin, and so forth). In the source file, syntax is displayed in a different color (or intensity) than other data you enter. The editor also checks that data files and field names are valid.

O'Hanlon's programming command language is robust and allows array manipulation. However, neither explicit "calculated" field types nor higher-order math functions are supported in the base language. Therefore, if you wanted to extend a unit price and quantity, you would have to do some programming in the data entry screen program. But you can perform program calls to operations written in assembler, Pascal, C, COBOL, BASIC, or any other language with an assembler interface.

AD HOC REPORTING An Inquiry facility for quick "ad hoc" reports on a single file allows you to place simple conditions on up to four fields, sort on one key field, and print a report to the screen, the printer, or a .DIF, SYLK, or ASCII file. You can store the inquiry for later use. This facility is useful for listings of master files or for simple reports.

When purchased in "educational packs" of 15 or more, copies of *The O'Hanlon Database Solution* are available for $30 each; an instructor's copy of the software and other documentation are included. *O'Hanlon* also sells source code for an accounting system that includes general ledger, accounts receivable, accounts payable, payroll, and wholesale distribution.

The O'Hanlon Database Solution has continued to evolve since its CPM beginnings and now offers a straightforward nonrelational approach to database programming. Among the package's strengths are its menu-driven forms, report generator, data dictionary, and query facility. Its inability to import ASCII files easily and its lack of a more sophisticated report writer are disappointments. Still, the availability of utilities and accounting source code lays the foundation for designing a complex system in a minimum amount of time.—**Timothy J. Lee**

Omnis Quartz

Blyth Software's *Omnis Quartz* ($795) is heralded as the first relational, multiuser database for *Windows*. Starting out as *Omnis*, a successful Macintosh product, *Omnis Quartz* was brought over to the PC world by Blyth Software in November of last year.

The end result is decidedly mixed. *Quartz* is both easy and hard to use. The package's *Windows* interface makes it easy to accomplish some tasks, and gets cumbersome to use in the middle of others. Its use of a mouse makes some features a breeze to control, but at other times, the point-click-drag-type-Tab-type-point-click procedures can become tiresome.

Without doubt, *Quartz* is powerful; just a glance at the manuals reveals that. It can relate multiple tables, it has extensive data entry and reporting features, and it also has a facility for creating custom menus. All these features may seem fairly standard for a programmable database. The surprise is that the entire *Quartz* program comes on a single 1.2MB floppy disk. Two other disks in the package hold a special runtime version of *Windows* 2.0. The package also includes 3½-inch disks; 360K 5¼-inch floppies are available on request.

Installation is fairly easy, thanks to

FACT FILE



***Omnis Quartz*, Version 1.13**
Blyth Software Inc.
1065 E. Hillsdale Blvd., #300
Foster City, CA 94404
(800) 843-8615
(800) 223-8050 in CA

List Price: $795
Requires: 640K RAM, hard disk, DOS 3.1 or later.
In Short: With its ability to relate multiple tables, its extensive data entry and reporting features, and its facility for creating custom menus, *Omnis Quartz* makes its power felt. The program is better suited for applications developers than end users; its use of *Windows* makes some tasks easy to accomplish and interferes with the completion of others. Not copy protected.

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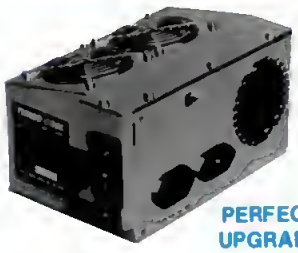


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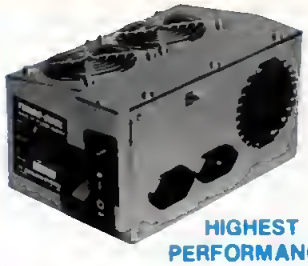


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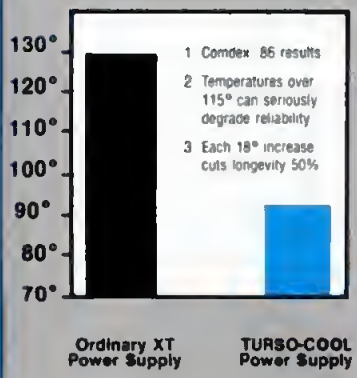


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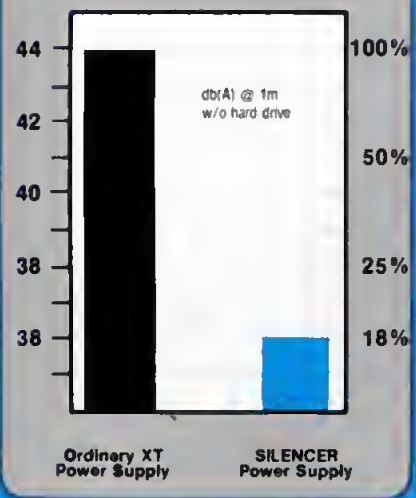
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well-designed utilities. Take care when you type in a user name, though, because you won't get a chance to change it. The documentation doesn't really explain why, but it turns out that a "stamping" procedure labels your copy of the program with that user name. The program is not copy protected, however, and you can reinstall it without any problem.

Once you install *Windows* and *Quartz*, you invoke the program directly from the DOS prompt. If you have the full version of *Windows*, you simply call up *Quartz* by clicking on its icon.

TOUGH TUTORIAL Before you can use the package successfully, you must negotiate the tutorial. Blyth doesn't spell it out in so many words, but there are actually two tutorials. The first, covered in the "Learning *Quartz*" manual, deals with flat-file, nonprogramming tasks. The heavy stuff appears in a second tome entitled "Applying *Quartz*." A third reference manual covers most topics, using the menu structure as an outline.

The quality of the tutorial varies. For example, the Address and City fields are separate when you define the file, but by the time you get to the data entry layout screen, it is assumed that they are a single field. Likewise, you are instructed to create a Department field with a length of five characters, but later must enter a ten-character item. You can burn a fair amount of time if you don't read ahead four or five pages to the place where the documentation explains what is needed.

Overall, the documentation is attractive in appearance but uneven in content. The manuals have a number of screen images, and most sections include examples, but since the examples are sometimes incomplete, you may find it difficult to implement some features. Because each manual has its own index and there is no master index, you have to look in three places to find all there is about a given topic. You will want to become familiar with the documentation despite its shortcomings, since the package has no on-line help facility.

USING THE PROGRAM *Quartz*'s default key assignments—such as Ctrl-N and Ctrl-P for moving to the Next and Previous records, respectively, in edit mode—are not permanent assignments. You can redefine the entire keyboard—for example, using Ctrl-P to call a custom report menu, as *Quartz* programmers did in one of the sample applications provided with the program.

It is fairly easy to set up single tables, as you just fill in a table and click on such items as "radio buttons" and "check boxes." In *Quartz*, as in some other database packages, you don't press the Enter key to advance from field to field on a data screen; you must press Tab instead. Should you press Enter, in error or out of habit, *Quartz* takes this as a signal that you are finished with this table and stores it away. You can disable the Enter key in custom applications if you have trouble adapting, however.

If you want to relate multiple tables, be sure to plan ahead. Rather than creating ad hoc linkages based on common fields, *Quartz* relies on connections established between records that then get stored internally based on the physical record numbers. That means that you need to define the links before you start to enter data; the task will be much more difficult if you attempt it after the fact.

A PLENITUDE OF PROCEDURES The procedural command portion of the program takes a variety of forms. Screen layouts, selection criteria, and report formats are all created and stored in their own ways. With a rather unusual editor that you access under the menu-building options, you can also create procedure files. *Quartz* prompts you with the full range of available procedure commands, and you point and click on the ones you want. Windows and boxes appear so that you can enter field names and other required information.

Quartz does not limit your choice of commands to only those that are meaningful and legal according to *Quartz* syntax. Also, there is no way to disable the menu-driven system and simply type in the procedure code you want.

The procedure file editor supports block operations, including cut, copy, and paste, both within a procedure and between different procedures. These capabilities are also available in the report and screen design modules.

SOME RESTRICTIONS APPLY *Quartz*'s procedure file capabilities are thorough, although there are limitations that some users may find unusual. For example, you must use the variables supplied by the system instead of creating your own, and you are limited to 60 numeric and 5 string variables. All procedures must be attached to menus, although you can configure them so that they do not appear. The hidden procedures can be assigned to push buttons on the data entry windows so you can trigger their execution without having to open a new menu.

There are other limitations that may take some adjusting to. For example, there are no ad hoc queries or lists in *Quartz*. You must define a report format in order to list records (or else define a list window as part of a data entry or edit procedure). Similarly, search criteria must be created as stored items, then applied to a file before running the report that lists the results.

On top of these limitations, *Quartz* is slow. Part of this problem may be attributable to its use of *Windows*, but even tasks that require virtually no display changes take significantly longer than they would with much of the competition.

If you use *Windows* and want to develop a customized turnkey application, *Quartz* may be a useful choice. And applications developed with *Quartz* should look and work the same under the OS/2 Presentation Manager. But you may find *Quartz* frustrating to use if you're looking for a program that offers multiple ways to achieve the same results. *Omnis Quartz* will let you accomplish just about any database task, but you'll have to go its way rather than your own.—**Alfred Poor**

1 on 1 = 3!!

Frank Rogers has a deal for you. If you want to try his new database program, send him a business card to get a copy of *1 on 1 = 3!!* free for a month. If you like it, send him $39, plus $4 to cover shipping costs; otherwise mail it back. The offer is just too good to resist.

1 on 1 is a programmable relational DBMS that Rogers calls a "*dBASE III Plus* work-a-better." Although it lacks some of the commands and facilities of *dBASE III Plus*, it makes up for them with

keystroke macros, customization features, and faster operation in the interactive mode. Rather than viewing his product as a *dBASE III Plus* competitor, Rogers sees one of its major uses as helping people learn *dBASE*.

1 on 1 is essentially the program core of *FoxBase Plus* with an operating and command shell written by Rogers, and it gives you many of the functions you'd get if you actually bought *FoxBase Plus* or *dBASE III Plus*. *1 on 1* creates and uses *dBASE III Plus*–compatible database files, including memo files, report files, and program files. Its index files are not *dBASE* compatible but are in the *FoxBase Plus* format.

1 on 1 works with PCs with two floppy disk drives, but a hard disk is recommended. The installation procedure is a mixed bag of ease and confusion. Installation is foolproof and runs from any of the three program disks, but during configuration you watch a blank screen, while you wonder if anything is happening, and then you see a long list of files scroll by without explanation. The program also requires that you set both Files and Buffers to equal at least 35 in your CONFIG.SYS file. Clear instructions are included for this procedure.

1 on 1 comes with just a few pages of printed documentation, including instructions for printing the 45-page tutorial and 79-page user manual that come on disk. The tutorial is a chatty, keystroke-by-keystroke walk through the major functions of the program. The user manual is basically a function and command reference, much of which is also available on-line and can be called up with specific commands. Rogers does not cover programming in this manual; he suggests users find a good *dBASE* programming book to master that aspect.

MODES AND MENUS *1 on 1*'s opening menu lets you choose between menu and command modes. Using the command mode is much like using the *dBASE III Plus* command line, while the menu mode is a fancier and more complete version of *dBASE*'s Assistant mode—complete with horizontal moving-bar menus, pop-up menus, and an 8-line operation or command help window.

A late addition to *1 on 1* (not yet covered in the documentation) is the ability to use a single key to execute commands from any menu without leaving the current menu. This feature, similar to opening windows, lets you layer menus up to 25 deep with a 640K computer; thus you can quickly switch program parameters or functions without having to back all the way out of the current menu.

Whether in menu mode or command mode, the process of setting up files and running *1 on 1* is similar to working with *dBASE III Plus*. A few of the screens are almost copies of *dBASE* screens, but most vary significantly. The major difference is a greater degree of user prompting in the menu mode of *1 on 1*. While *dBASE III Plus*'s Assistant mode includes only a subset of *dBASE* commands, *1 on 1*'s menu mode is more complete; it also lets you drop quickly to the command mode or to DOS and then come right back to the menu you were in.

1 on 1 includes a basic editor for writing command files, but you can use any text editor or word processor that can save ASCII files. The first time you execute a *1 on 1* command file, the program compiles the file just before running it. The next time it runs, it works faster.

The filter feature lets you select records that meet specific criteria from a database. Once you've created a filter, it can be saved, modified, or specified as a condition for working with other commands. The filter lets you see a subset of a file as if it were the file itself.

Another *1 on 1* feature is Picture; it lets you save the current settings for active and primary indexes, file relationships, filters and filtered files, report and label control files, and output devices and files. Using Picture is a convenient way to take a "snapshot" of the current working environment and bring it up at a later time without having to respecify all of the options.

MACROS *1 on 1*'s ability to create keystroke macros is especially helpful. While in the menu mode, you can name a single-key macro, which is the equivalent of redefining a key. Once you select the key to redefine, the program records your keystrokes until you tell it to stop. As long as the macro is in memory, the redefined key executes the memorized keystrokes.

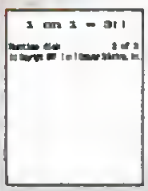
There is no limitation on which keys can be redefined, but it's a good idea not to use keys that are used in command menus, or number keys, or other special keys like cursor control keys. You can use the F4 through F10 keys alone or in combination with Ctrl, Alt, or most letter keys.

Normally macros stay only in memory, but if you have processes or keystroke combinations that you use for many files, you can create a series of macros, save them permanently in a macro file, and then load them into memory whenever you need them.

SPEED VERSUS SIZE The PC Labs benchmark-test results show *1 on 1* to be speedy, especially with smaller files. In addition, I tried using both *1 on 1* and *dBASE III Plus* to index a 23,493-record mailing list file on a single 15-character last-name field. It took 4 minutes and 23 seconds for *dBASE III Plus* to complete the job, but only 2 minutes and 3 seconds for *1 on 1*. The program is especially fast in the interactive command mode.

While Rogers is certainly interested in selling his program, he is quick to point out that it runs command files slower than does *dBASE III Plus* and is best used for relatively small applications. *1 on 1* is not positioned as an applications development tool, although it could certainly suffice for

PC MAGAZINE FACT FILE



***1 on 1 = 3!!*, Version CC1.0**
1 on 1 Computer Solutions Inc.
26 Finchwood Dr.
Trumbull, CT 06611
(203) 375-0914
List Price: $39; 1-month free trial period before payment.
Requires: 512K RAM, two disk drives (hard disk recommended), DOS 2.0.
In Short: The least-expensive DBMS reviewed in this issue, this is a "*dBASE* work-a-better" from a small, new company. It lacks some of the facilities of *dBASE III Plus* but adds keystroke macros and customization features, operates faster in interactive mode, and creates *dBASE*-compatible files. Not copy protected.

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Automatic Mainframe Data Conversion to dBASE III	☑	☐	☐
Lotus WK1, WKS	☑	☐	☐
Move Calculated Data to Lotus 1-2-3 model	☑	☐	☐
Workstation Manager Menuing Program	☑	☐	☐
Menu-based DOS Utilities	☑	☐	☐

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CIRCLE 247 ON READER SERVICE CARD

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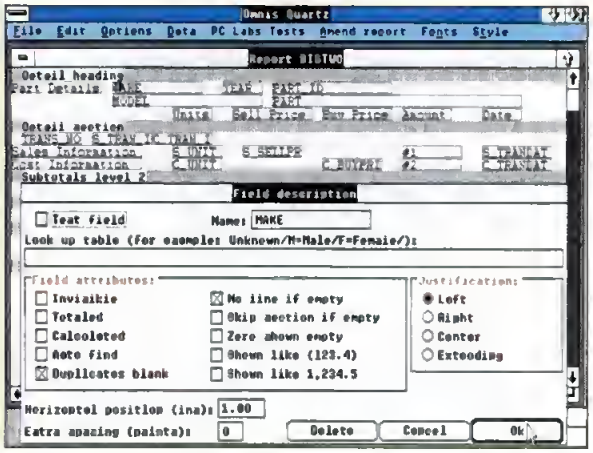
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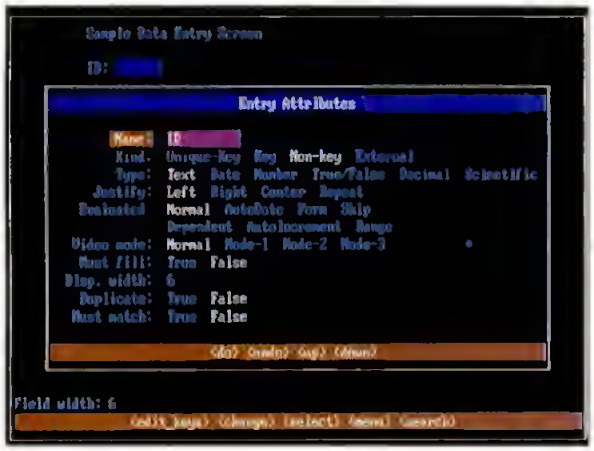
CIRCLE 104 ON READER SERVICE CARD



Each field in an **Omnis Quartz** *report format must be defined using this description window. The underlying window shows the "painted" report format, which labels the various fields by name, making it easy to identify their contents.*



1 on 1 = 3!! *has a user-assistance mode (called the menu mode) that combines horizontal moving-bar menus, pop-up option menus, and eight-line help windows. This mode is selected at start-up as an alternative to the quicker* dBASE*-style command mode.*



Open Access II *allows designers to select from a fairly comprehensive set of field attribute options, including "external" and "must match" classifications that are used to trigger linkage to related files during data entry.*



The **Paradox** *report generator is powerful and flexible. You define breaks in terms of horizontal bands, and data fields in terms of vertical columns. You can also access system variables (such as page number and date) or calculate fields on the fly.*

applications of modest size.

The major limitations of *1 on 1* reflect the size of the company and the age of the product. Rogers's company, 1 on 1 Computer Solutions, is small, with Rogers playing most of the roles—including those of programmer, documentation writer, marketing director, and customer support specialist. *1 on 1* is only in its first release; as with other fledgling software products, it will take some time before all the bugs are discovered and corrected.

A major investment in *1 on 1* is probably not prudent until the product ages a bit and the company grows. In the meantime, at $39, *1 on 1 =3!!* is a great deal for those who would be glad to have a *dBASE III Plus* clone and to learn about programmable relational databases in general. Since you can try the program free for 30 days, it's hard to imagine how you can lose.

—Bruce Brown

Open Access II

Integrated-software lovers hankering for a package with a "real" database may find their dream has come true with *Open Access II*. Even in its $295 standalone version, the database has much to recommend it. Power users will enjoy the comprehensive array of options and programming capability despite the limitations in the documentation and in some aspects of the programming environment.

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- DataPerfect 2.0 299

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- Printer Stand PS-1 18
- Universal System Stand SS-3 25.
- DS-1 Switch Box *(controls 2 printers)* 33

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- Printer-to-IBM cable *(9 feet)* 17.

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- Diamond SP-1 *(6 outlets)* 32
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- LQ-850 printer *(80 column, 264 cps)* call
- LQ-1050 printer *(136 column, 264 cps)* call
- LQ-2500 printer *(136 column, 324 cps)* call
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- *Printer-to-IBM cable (6 feet)* 15

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- 2400 Baud Internal Modem 199

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Prospective buyers may choose among four versions of the program: single-user or network-ready flavors of a standalone database manager, or one integrated with spreadsheet and graphics, word processor, and communication modules. All versions offer pop-up "accessories," among them a scientific calculator, appointment book, notepad, stop watch, and value converter.

Based on relational database structures, *Open Access II* contains all the tools needed to develop complex applications involving up to eight related files. These include a Database module for menu-driven definition, query, update, and reporting operations, a Programmer module for program editing and testing, and a Utilities module for configuration, data conversion, and application menu maintenance. The integrated version also offers the means to pass data between a database and a spreadsheet or word processing document.

The Programmer language offers a number of features that extend the functionality available through the Database interface. Foremost are its facilities for customized menus and windows with panes. The language supports structured programming style and includes a subset of SQL for data retrieval purposes.

STARTING UP Getting down to work should be easy, even for inexperienced users. Installation is a snap, and device and preference configuration is straightforward. Patient, knowledgeable assistance on all aspects of the program is available from the vendor's technical support staff, which handled my calls capably.

The documentation consists of a slim, bound manual for each module, divided into tutorial and reference sections, and a foldout quick-reference card. There is no function key template, though one is sorely needed. Sample data files and programs are included for use in conjunction with the written tutorials. The context-sensitive, on-line help is only fair.

You create data files by painting a data entry/retrieval form on-screen, and you use function and cursor keys to indicate field placement and size. After identifying a field, you specify its attributes in a pop-up definition screen. Fields from related files may also be displayed on the form without having to be included in the file.

Fields may be classified as unique keys, repeating keys, or non-keys. Field types may be text, number (integer), date (with a four-digit year in all date styles), true/false, decimal, or scientific. A host of other attributes may be specified for range checking, justification, decimal precision, auto-incrementation, color, and validation against data in related files. Data from related files may also be displayed on the form in "external" fields.

It is possible to design nearly "bulletproof" entry screens that, in tandem with *Open Access*'s built-in search key and macro facilities, eliminate much of the tedium of data entry. Still, the program ought to provide for field templates with punctuation and also improve its range-checking feature.

REPORT AND RETRIEVAL *Open Access*'s report generator is another capable performer. First, you specify what data to use with From, Select, Where, and Order clauses. You then proceed to type in header, footer, and subtotal text, place fields in the body of the report, indicate level breaks, and specify arithmetic operations to perform. The program supplies useful defaults and speed keys that expedite report definition.

Unfortunately, the data selection criteria are hard-coded in the form specifications instead of being structured as parameters that could be replaced at print time. This limits the usefulness of the form for programming purposes.

Open Access's menu-driven procedures for multifile data retrieval and manipulation are numerous and well implemented. They nearly obviate the need for custom programs and include password protection, browse, query, entry, retrieval, cross-tabulation, and update procedures. The network version also offers flexible record- and file-locking options. No special attention must be paid to index files: the system maintains them automatically.

PROGRAMMING ENVIRONMENT Programming with the *Open Access II* language should come easily to anyone familiar with another high-level language. The sample programs included with the package are good examples for beginners to imitate or modify for their first attempts.

Most of the functions, operators, and language constructs necessary for general-purpose programming are included, with the exception of time functions and access to nondatabase files. The language supports modular programming and is particularly well suited to user-interface routines.

Open Access programs are *interpreted* as opposed to *compiled*. Execution tends to be slow and cannot be accelerated by abbreviating keywords. Random access of data is particularly slow, especially in procedures that handle large data files.

Debugging programs is a chore; the reference documentation is much too brief and badly organized as well. The system's best debugging tool is a trace window that displays program statements as they are executed. This makes it easy to identify errors when a program bombs. But it is much too difficult to determine the state of files and variables after an error occurs.

Although the programming environment is not as rich as the database, it is slated for improvement with the addition of compiler and runtime facilities. Still, *Open*

PC MAGAZINE FACT FILE



***Open Access II*, Version 2.05**
Software Products International
10240 Sorrento Valley Rd.
San Diego, CA 92121-1605
(800) 521-3511
(800) 621-7490 (in Calif.)

List Price: Standalone database: single-user, $295; network, $195 server pack plus $245 per station. Integrated database: single-user, $595; network, $195 server pack plus $395 per station.

Requires: 256K RAM (320K for network version), two disk drives (hard disk recommended), DOS 2.0 or later.

In Short: A feature-laden relational DBMS with an excellent user interface. The program is suitable for small to medium-size database systems, and forthcoming improvements should qualify it for handling large databases. Not copy protected.

CIRCLE 686 ON READER SERVICE CARD

Access's programming environment is far superior to "macro" languages. Completed applications of one or more program modules may be "arranged" and placed in an applications menu. This speeds execution somewhat, and more important, it allows other users to access programs easily.

Overall, the *Open Access II* database environment provides an excellent user interface and good performance. The system becomes increasingly attractive as you work with it—a mark of good software. Once you are familiar with the function keys and built-in shortcuts, you can execute a wide variety of tasks quickly. If and when the programming environment is beefed up with a compiler and debugger, *Open Access II* will become a truly impressive performer.—**Gene Smilgiewicz**

Paradox

Here's a paradox for you. How can a database management program be sophisticated and simple? Easy to learn and difficult to master? Programmable but not requiring any programming? That's not just a paradox, that's *Paradox*, the $725 database management program produced by Ansa Software, a subsidiary of Borland International Inc.

In many ways, *Paradox* is similar to much of the competition. It handles multiple tables and can link them in various ways. It has a menu-driven interface but also can be run entirely through a powerful programming language. It comes with a sophisticated application generator that you can use to create complex custom applications, which can be executed from a single command at the DOS prompt.

But in most respects *Paradox* is different from almost every other player in the field. It is based on some strong philosophical design concepts and a unique model, making it different to learn and use in a number of significant ways.

PARADOX PRINCIPLES To start with, everything in *Paradox* goes into tables. Not only does *Paradox* store your data in tables, but the results of queries go into temporary tables; so do lists of records with duplicate key-field values, records to be added to a table through data entry, and records that have been changed or deleted through batch update operations. *Paradox* even stores the structure of a table in a special table.

Paradox is also different in that it divides many processes into separate steps. In some competing programs, you can write a simple procedure (or even a single command) that will extract certain fields from selected records within a set of tables, sort the results, and list the data in groups with subtotals. Not so with *Paradox*. The query that produces the field and record selection is performed as one step, which then produces a temporary table as a result. You must then call a custom report format to group and print out the data.

■ *Paradox* is different from almost every other player. To start with, everything goes into tables.

This multiple-step process creates some significant complications. On the query step, the order in which you open the tables can have a significant impact on the data you receive as a result. Since the answer table that is produced is temporary, you must go through a number of steps to retrieve a report format (stored in a permanent template table) and make it available to the temporary table.

None of these complications is a flaw from a performance point of view; *Paradox* performs extremely well. But these factors may increase the time you spend learning how to use the program. If you know *dBASE*, you may have to spend some time unlearning that package's way of doing things. The features of *Paradox* work much like *Lotus 1-2-3* database ranges, so *1-2-3* users may find the transition easier to make.

These caveats aside, *Paradox* has a lot to offer. To begin with, it can be extremely powerful and easy to use once you get the hang of it. For example, I was able to perform every phase of the PC Labs benchmark tests without having to write a line of code.

BUILDING AND USING TABLES *Paradox* provides menu choices for many items that would require custom programming in many other database systems. For example, it offers five different field types: alphanumeric, number (with decimals), currency, date (three formats), and short number (integer). Once you define a database structure, you can quickly and easily modify it without losing data. If the new structure is not completely compatible with existing data, *Paradox* will report on any exceptions and give you the opportunity to edit the offending records.

The field type choices are made more powerful by the ValCheck menu option, which permits you to define validity checks for individual fields. You may specify a maximum or minimum value that can be accepted, a default value, or a table lookup. You can also specify whether or not a response is required for a given field.

Table lookups are especially powerful options. You can easily arrange for the program to display the reference table, where you select the value you want by placing the cursor on the appropriate record. *Paradox* will even bring back data from related fields and automatically enter it in the current table.

The table view is flexible, and you can display more than one table at a time. You can rearrange the column order, adjust column widths, and more. Should you prefer

EDITOR'S CHOICE

FACT FILE



***Paradox*, Version 2.0**
Borland International Inc.
4585 Scotts Valley Dr
Scotts Valley, CA 95066
(800) 543-7543
(408) 438-8400
List Price: Standalone version $725; LAN version, $995.
Requires: 512K RAM, hard disk, DOS 3.1 or later.
In Short: *Paradox* has a unique design favoring *Lotus 1-2-3*. The package uses tables as an organizing principle; it supports free-form reports, provides a range of menu selections, and includes powerful table lookups. Not copy protected.

CIRCLE 669 ON READER SERVICE CARD

a formatted data-entry screen, you can get that too. *Paradox* will create a form for you, placing each field on a separate line and using the field names as prompts, but you can also design up to 15 different forms for each table using the full-screen form editor. All tables are saved automatically when you clear them from the workspace.

QUERIES AND REPORTS Linking tables for queries is easy—once you get the hang of it. *Paradox* will present you with a query form for each table; you check the fields you want included, then place an "example" in each of the corresponding fields. For instance, say you had two tables that had a common field, Part Number. On each table's query form, you place an example in the Part Number field, such as the word *apple*, and every record that has the same Part Number in both tables will result in a record in the Answer table. (Note that the Part Number does not have to have the value *apple*; the example only serves as a reference for the comparison of values between the two tables.)

The report formatting program is also easy to use once you understand how it works. A full-screen editor allows you to define "bands" that control groupings and page breaks. You can specify sorts to be performed at the time of reporting, up to 16 levels deep per report. You can even specify that a blank space is to be printed after every so many records.

Paradox also supports free-form reports, which can be used to create just about anything from invoice forms to simple form letters. And it can print mailing labels with blank-line suppression and multiple labels across a page.

Paradox offers a host of other valuable features. There are options that give you great latitude in setting custom configurations. There are two different ways to exit to DOS temporarily and then return to *Paradox* without reloading it. And *Paradox* offers a variety of powerful data import and export facilities, making it an amicable working partner for many other popular programs.

HELP AND HINDRANCE *Paradox* comes with a mass of documentation—about 1,500 pages of attractive, well-designed, thoroughly indexed, and copiously illustrated manuals. There are plenty of examples and a good printed tutorial. The manuals are paperbound books, which may make it difficult to add updates and corrections.

Installation is a little uneven, only because you have the choice of whether or not to install a number of options. Rather than use a single installation procedure that lets you select among options, you must initiate the installation process for each module separately. The program comes with eleven 5¼-inch distribution disks as well as seven 3½-inch disks in the same package.

Paradox is not copy protected, but you must initialize the program with the package serial number—which, paradoxically, is not the serial number on the label of the package! *Paradox* programs have *two* serial numbers, and it took a while for me to realize that the real one was hiding on a small slip of paper in the keyboard template envelope.

Overall, *Paradox* is a serious contender in the high-end database marketplace. It favors the spreadsheet user who has come to realize that spreadsheets just aren't suited for large database applications, and who wants to transfer as many concepts and skills as possible to the new environment. *Paradox* is fast in many of its operations and is relatively easy to use to develop custom applications.

If you can adjust to its demands on how applications and procedures must be structured, *Paradox* represents significant value. It's a product that will be difficult to outgrow.—**Alfred Poor**

pcExpress

Picture an enormous spreadsheet with two, three, four, or even more dimensions—a spreadsheet that is far too large to fit into memory but can be paged in and out from your hard disk as necessary. Picture this, and you have a good idea how *pcExpress* works. An offshoot of Information Resources' popular mainframe database called *Express*, *pcExpress* is a $1,495 multidimensional relational database with a greater capacity and a richer command language than any spreadsheet product.

pcExpress's multidimensionality replaces the multiple files of more conventional database programs. It's a logical way to organize complex data. Suppose you are constructing a database to contain sales information. The rows might be the cities where you have offices and the columns might be the widgets and gizmos that you sell. The cells, of course, define the quantities for whatever month the database represents. (Conventional database terminology calls the columns *fields* and the rows *records*.)

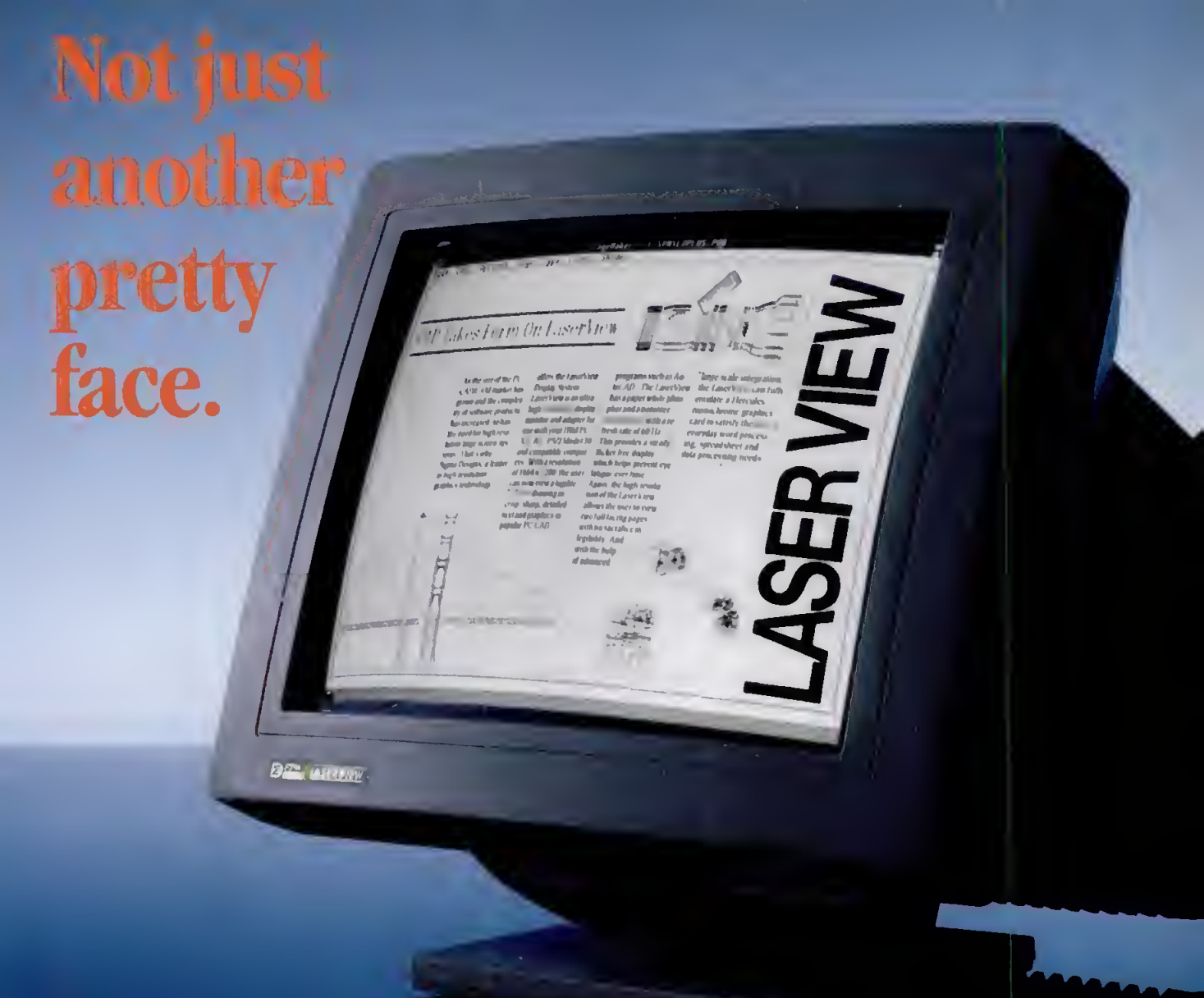
Now you want to add sales for a new month. Instead of making a second file and relating it to the first one, *pcExpress* allows you to use the third dimension to represent months. In fact, *pcExpress* allows you to have six dimensions, so a fourth dimension in our example might be type (such as actual sales or forecast sales), which would share the dimensions of time, office, and product.

pcExpress is command driven, and like most command-driven software, it can present an overwhelming challenge to the beginner. The Reference Manual runs more than 400 pages; the Command Users Guide is 250 pages long. Fortunately, a friendly, menu-driven interface program called EasyExpress lets an inexperienced user create and use a database. EasyExpress has about 80 percent of *pcExpress*'s commands, and it is the recommended way to enter data from the keyboard.

SLOW IMPORTS AND SWIFT SWAPS Because of the system's dimensionality, importing a file into *pcExpress* is cumbersome. First, you "dimension" and define the database, then you read the file into a temporary worksheet, and finally you unravel the data from the worksheet into the variables (fields).

Whatever the method of input, all information—including definitions, programs, and data—is eventually stored in a single DOS file. There is a sizable overhead for small databases: our 500-record test file generated a *pcExpress* file of 590,000 characters; our 5,000-record file expanded to 1,341,000 bytes. We were unable to import the 50,000-record test file. After grinding away for 4 hours, the import process aborted with a message that indicated an internal error. A spokesman said this was because a vector length had become

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S I G M A D E S I G N S

PC MAGAZINE FACT FILE



***pcExpress*, Version 1.5**
Information Resources Inc.
200 Fifth Ave
Waltham, MA 02254
(617) 890-1100
List Price: $1,495
Requires: 640K RAM, hard disk, DOS 2.0 or later.
In Short: A spreadsheetlike relational database that incorporates multiple dimensions and a user-friendly interface called Easy Express. This is not a product for large files, but good for users who like spreadsheet organization. Copy protected.
CIRCLE 685 ON READER SERVICE CARD

negative—a known bug that occurs sporadically when *pcExpress* is executed from a subdirectory. Yet a second attempt, executing *pcExpress* from the root directory, resulted in the same error.

Execution times for the various operations are fast because of the program's sophisticated memory management. Data swaps to and from disk are invisible to the user, and disk caching keeps seeks to a minimum. Some operations, like joining two tables, are extremely fast because they do not involve actually moving data, but just redefining the relationships.

PROPRIETARY LANGUAGE *pcExpress* lacks the popular Structured Query Language, but it has a proprietary fourth-generation procedural language that allowed it to perform PC Labs SQL tests. EasyExpress is a good testament to the robustness of this language. Like several other applications that Information Resources markets, EasyExpress is written entirely using *pcExpress* commands.

Many tasks that require writing a program in other databases can be done directly from *pcExpress*'s command line. The powerful Table command, for example, automatically creates two-dimensional slices of the database for viewing, editing, and data entry. The Limit command reduces the scope of data much as an IF statement and a loop might in a program. And the Report command automatically loops over the dimensions of the data to produce an attractive report in a default layout.

pcExpress is rich in analytical tools, including those used for forecasting, multiple linear regression, and graphing. With EasyExpress, you can produce descriptive graphs just by selecting options from a menu. And EasyExpress also has a Summary command that can save hours of drudgery: it subtotals, aggregates, averages, and calculates percentages with a minimum of fuss.

REACHING ITS LIMITS On the negative side is *pcExpress*'s limited communications capabilities. It does not support synchronous communications such as IBM's SNA, nor is it a Local Area Network product. It does support asynchronous public networks like Tymnet and Telenet, and the next version, according to a spokesman, will have more communications features.

pcExpress derails when it comes to large databases. Although we were not able to import our test file of 50,000 records because of the vector bug, it's not clear whether the data would have fit on the disk anyway. Since all data is stored in one file, the DOS limit of 32MB can be a serious impediment.

This is not the program to pick if you have large databases to manage, but for small to medium-size work it's a good choice for users who like spreadsheet organization.—**Donald B. Trivette**

PC/Focus

In the mainframe world, Information Builders' Focus is one of the premier DBMS/fourth-generation language programs, offering both power and flexibility. In the micro world, though, *PC/Focus* is virtually a vertical-market program: if you don't have the mainframe version, you probably wouldn't be interested in the micro version. That means a lot of people will never get to use an exceptional DBMS program. Then again, it means they will never be frustrated by this $1,295 package's arcane documentation, its inconsistent user interface, and its lack of PC amenities.

PC/Focus is a full-fledged DBMS, complete with procedural and nonprocedural commands for application development, a full-screen text editor, communications device drivers for mainframe connectivity, and a graphing module for report generation. It also offers generators for creating executable procedures (with and without prompts) and pop-up windows. All of this power comes on 19 disks, one of which is a backup keydisk: *PC/Focus* is one of the few copy-protected programs on the market today.

PC MAGAZINE FACT FILE



***PC/Focus*, Version 3.0**
Information Builders Inc.
1250 Broadway
New York, NY 10001
(212) 736-4433
List Price: $1,295
Requires: 640K RAM, hard disk drive, DOS 2.0 or later.
In Short: *PC/Focus* is an extremely powerful hierarchical DBMS with a mixture of mainframe and PC interfaces. Its special strength is its ability to interface with the mainframe version, Focus; unfortunately, that may also be its biggest drawback for non-Focus users. Copy protected.
CIRCLE 697 ON READER SERVICE CARD

Unlike most of the programs reviewed in this issue, *PC/Focus* is not based on the relational DBMS model—although it can perform relational operations—but on the hierarchical model. A hierarchical-based DBMS stores data as fields and records within segments, at least one of which must be a parent. Other segments descend from the parent and are related to it as children. You can locate the segments within the same logical file (as with *R:base*) or outside of it (as with *dBASE*). You can even cross-reference segments recursively; in effect, the parent is parent and child.

From a design viewpoint, *PC/Focus*'s hierarchical model provides more flexibility than the relational implementations found in many SQL-based DBMSs. It does have its drawbacks, however. Queries must be channeled through the parent segment or through a view that substitutes its child as the parent, and index fields must be at the front of the record and declared during data definition. As a result, if you do not know the layout of the fields,

The best ad for Key Tronic keyboards is a close look at the competition.



Last spring a certain quality conscious consumer purchased what he thought was a Key Tronic KB 5151 Professional Series keyboard from a local retailer.



Look for the Key Tronic Professional Series label on the keyboard's top left hand corner.

This same consumer later returned the keyboard to Key Tronic with a letter of complaint. The product, shown above, was used for just over a year, though it looks like it was abused for much longer. Some of the keycap legends had worn away, and had to be replaced by the stick-on labels you see here.

Truth is, while the above product was sold as a Key Tronic keyboard, a Key Tronic label never appeared on the product. There is no way it could have. Because only keyboards bearing the leading name in keyboard technology offer the quality behind that name.

Close examination will tell you immediately if the keyboard you are purchasing is from Key Tronic. First, look for the Key Tronic Professional Series label in the top left hand corner. Look also at the keyboard's legs to see if they have a rubberized non-skid covering, just another of the Key Tronic extras that ensure better performance.

Of course there are other features, not initially apparent, that separate a great keyboard from a mediocre one. Take Key Tronic's double shot molding, for example, a process that prevents the keycap legends from wearing away (which proves that the keyboard shown above is not from Key Tronic but rather the handiwork of a lesser manufacturer). And then there is Key Tronic's limited three-year warranty: a reliability guarantee that is backed by over eighteen years' experience making over eight million keyboards.



Double shot molding embeds the keycap legend in colored plastic, so it won't wear off.



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CPU 286/10

- Same as above with 286-10 CPU, 0 wait state; SI: 11.5, 12MHz throughput; fixed bus wait state

BASIC SYSTEM

The CPU 286/12 and CPU286/10 are configured as follows:

- 512K of 0 wait state RAM: CPU 286/12, 80ns; CPU 286/10, 100ns
- 1.2MB floppy drive
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- 101-key enhanced keyboard
- 8 expansion slots
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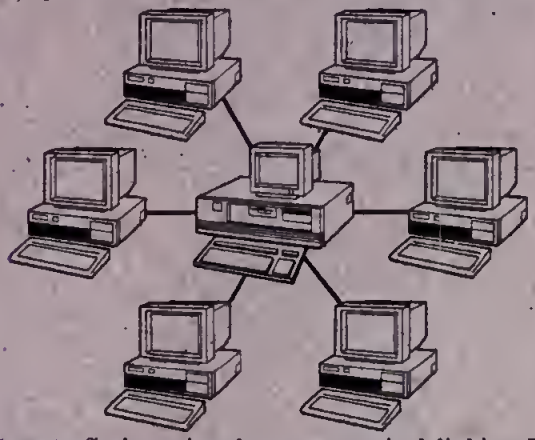
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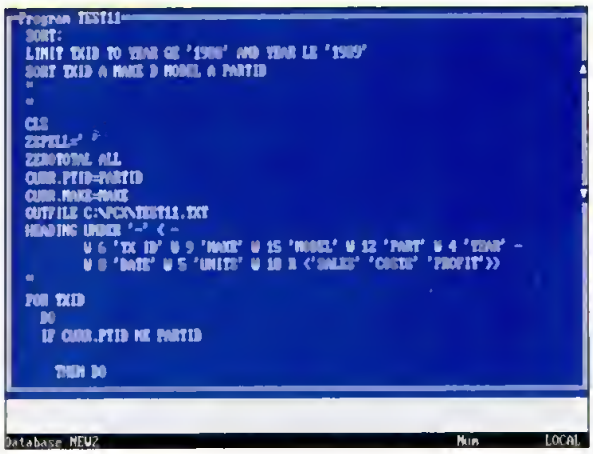
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Local inquiries: (818) 338-5959
Tech. Support: (818) 814-2367

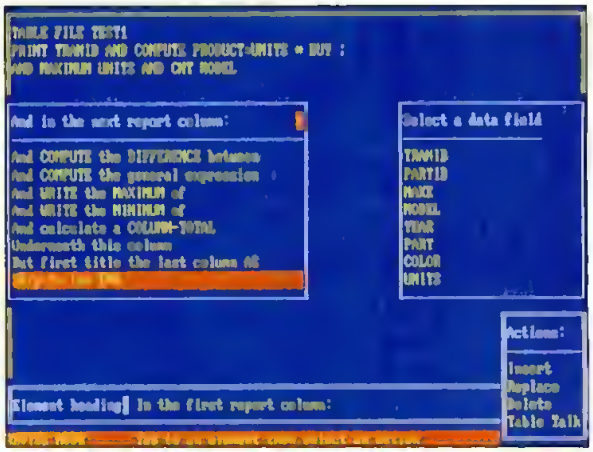
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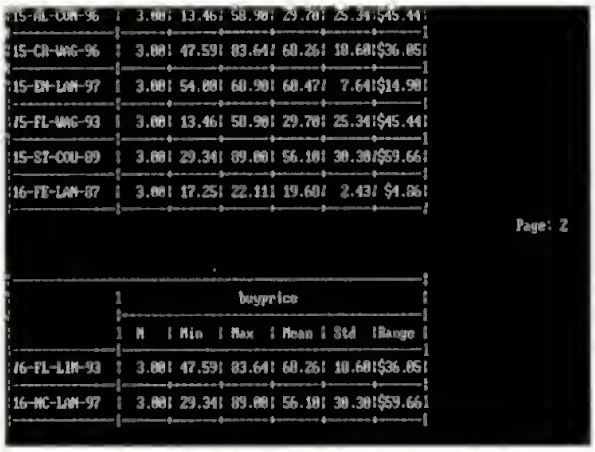
Computer Products United



Although **pcExpress** *doesn't support SQL, it has an equally powerful proprietary language. Here the language is used to format and print a report.*



TableTalk, one of **PC/Focus***'s many Talk Technology modules, lets you generate simple reports without coding. You first select the action and area, then save and execute the command.*



Here **PRODAS** *displays a screen report for several part numbers' selling prices, including the number of occurrences of each part number, minimum price paid, maximum price paid, mean price, standard deviation, and range. It took less than a minute to produce the complete report for a file of 500 records.*



Progress *controls all files, fields, and indexes from within its data dictionary. The "Cust-num" field is assigned a right-justified numeric format; "Customer Number" represents the label appearing on-screen, and error checking with help messages ensures a value greater than zero.*

you cannot query or modify the database. Also, any changes to the structure of the database need to be handled very carefully, since removing or adding a field may upset the various links between the segments and effectively render all of the data within the database unusable.

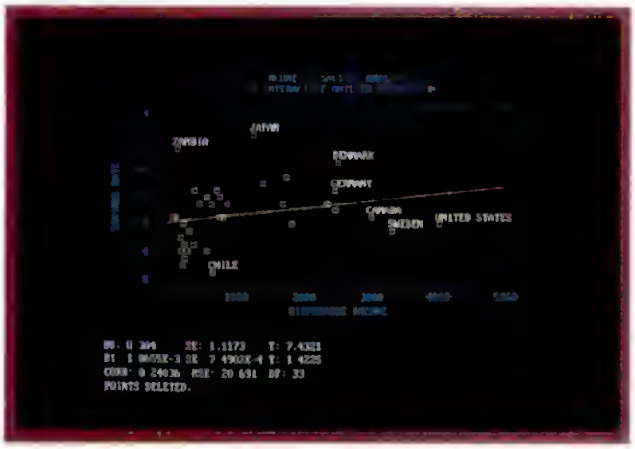
POWER AND FLEXIBILITY Because of these reasons and others such as the need to name columns uniquely, regardless of the segments they are in, you need to spend more time and care in designing a *PC/Focus* database and its applications than you would for a relational database. But once you do, you have power and flexibility few programs can rival.

PC/Focus allows you to execute queries or data manipulation operations via FOCEXECs or interactively on the command line and through the appropriate Talk Technology module. FOCEXECs are executable Focus procedures that you create (usually with TED, the built-in text editor), using the Focus language. The language provides commands for database definition, data manipulation, prompting for variables, and controlling the request flow. While the language itself is fairly straightforward, the documentation is confusing, in part because it assumes you are a mainframe Focus user.

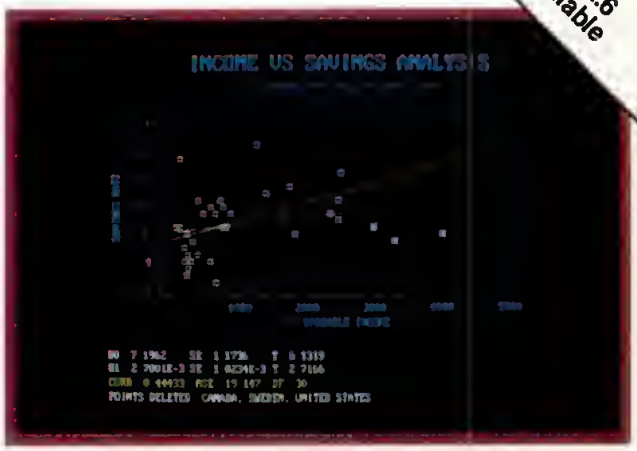
Talk Technology is *PC/Focus*'s equiv-

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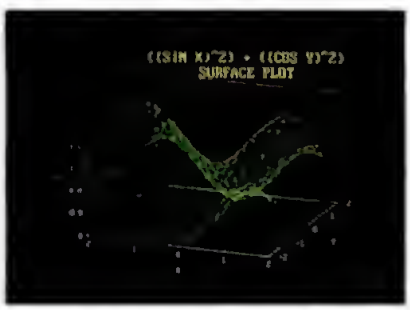
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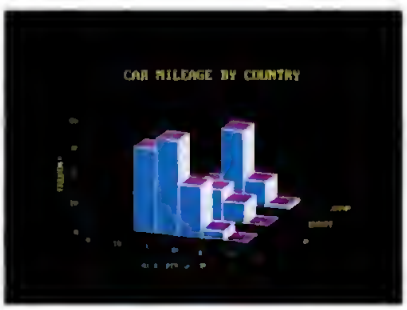
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alent of *R:base*'s Express modules. Each Talk module enables you to manipulate data or screens in a relatively user-friendly manner, with scrollable menus and explicit prompts. ModifyTalk, for example, provides prompts for appending, updating, and deleting fields and records. FileTalk offers the same capabilities for querying the database and generating reports.

Window Painter is an impressive, elegant new module that lets you create windows that pop up, accept parameters, and list file or field names. You can also use it to design a window that executes DOS commands. (*PC/Focus* allows you to execute DOS commands, but you must preface each command with the word DOS.) Windows can call other windows or execute Focus procedures.

Because *PC/Focus* was brought down from the mainframe world, it has many of the same characteristics as its older sibling. Some of them—such as the use of "ddnames," a variable that is replaced at runtime with a file or device name—simplify and encourage batch processing and file maintenance; others—such as the inability to recognize DOS subdirectories—hamper the experienced PC user. (According to the vendor, *PC/Focus* users get around the lack of subdirectory support by executing DOS's SUBST command—an effective but less-than-elegant solution.)

STEEP LEARNING CURVE Although attempts have been made to update the user interface with graphics, prompted menus, and other features found in many popular PC programs, they appear to be halfhearted and incomplete. Information Builders wants to maintain a similar user interface in its mainframe and PC versions. The result is a lack of consistency in key usage and an apparent disdain for PC conventions. For example, ending or canceling an operation in *PC/Focus* is accomplished with F3, End, or Fin, depending on the module being used. While such inconsistency can be dealt with, it creates a steep learning curve for first-time users.

PC/Focus's roots in the mainframe world became quite evident during the PC Labs benchmark-test import task. For one thing, there's the program's lack of subdirectory support. Then there's its inability to import a standard ASCII-delimited file. Finally, *PC/Focus* does not allow you to use slashes within its date fields, even though the program allows slashes for display purposes. Other programs that have their origins in the mainframe and minicomputer worlds, such as *Informix-SQL* and *Oracle*, exhibit similar problems with date fields and delimiters, but they do provide subdirectory support.

Also irksome is the way the system hangs when you try to perform global updates or use the Case at Start statement without specifying a transaction file for input. Evidently, Information Builders assumes that you will run updates either against a transaction file or with prompts. Other mainframe characteristics include the TSO-like text editor, the need to "end" processes so that you return to the main command line, and the inability to redefine the database structure easily (although this last characteristic is also a factor in the hierarchical model).

Despite the flexibility and power offered by *PC/Focus*, I cannot recommend it to end users, developers of standalone applications, or power users who do not intend to connect their PC databases to mainframe databases. At present, *PC/Focus* does not offer enough of the amenities PC users have come to take for granted, such as consistent key usage, context-sensitive help, and hassle-free import and export modules. Until Information Builders revamps its interface and manuals to cater to PC users, *PC/Focus* will continue to appeal almost exclusively to mainframe Focus users.—**Vincent Puglia**

PRODAS

"There is measure in all things." If you can measure it, *PRODAS* (Professional Database Analysis System) can help you find a unique way of analyzing and presenting it. Priced at $720, *PRODAS* is a fast, powerful, program-driven statistical database system with a rich programming vocabulary and a range of graph types that can show special relationships.

Installing the system, which consists of tightly written independent modules, is quick and easy. Documentation consists of two reference volumes, a quarterly newsletter and a user guide. The user guide features an excellent tutorial designed to give you the skills to exploit the power of the system. Conceptual Software holds 3-day user training sessions in Houston and Washington, D.C., at $475, with educational and multiple-individual discounts available.

Importing data from ASCII, *Lotus 1-2-3* or *Symphony*, *dBASE III*, or *SAS* is easy using *PRODAS*'s Transfer module. You may invoke it by using the program language interactively or using the Quick Editor (QED) to create an ASCII batch file. If you are familiar with other statistical programs, such as BMDP, SAS, or SPSS, you will feel right at home using *PRODAS*'s commands. You indicate the length of alphanumeric fields but not numeric, date, or currency fields.

The system stores numbers in double-precision floating-point format. This permits greater accuracy on computational results. Numeric fields can be concatenated with alphanumeric fields to create a unique key for the file. (Other database products often do not let you mix field types for generating a concatenated key.) The number of keys allowable is limited only by the amount of hard disk space you have available.

APPROACHES TO PROGRAMMING *PRODAS* also displays how long it took to execute commands. This is useful when you need to tune a set of commands, since you can easily see the impact of altemative program approaches on execution time. File lengths and the number of fields per record are limited only by your hard disk drive. Some users have up to 800 fields on a record.

Users new to programming may find *PRODAS*'s programming language a bit intimidating. Programming in *PRODAS*'s batch mode is easier because you get meaningful error messages when the syntax is incorrect. If you choose to program interactively, you can later save your commands to an ASCII file, which you can then edit to create a batch program.

PRODAS has a menu command and a macro facility that you can use to build either a customized interface for the system or your own customized applications. According to the vendor, the next release of *PRODAS* will have a menu-driven option,

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***PRODAS*, Version 3.2**
Conceptual Software Inc
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Houston, TX
77256-6627
(713) 667-4222
List Price: Database, $720; graphics, $365; statistics, $420.
Requires: 320K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: *PRODAS* is a powerful program-driven statistical database system with a range of graph types to show special relationships. It lacks an elegant interface but is an effective business tool with a rich vocabulary of functions. Not copy protected.
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which should greatly increase the program's ease of use for new users.

Once you've loaded the database, you can review its structure with the Contents command, and you can use the Proedit utility to enter and edit records interactively. Retrieving data in *PRODAS* is almost instantaneous. The command structure is simple, and a form can be automatically generated to display data. Reports can be generated with just a few lines of code, and complex IF statements can be used with parentheses to select records for inclusion in the report.

SUBLIME STATISTICS *PRODAS* shines in its statistical and mathematical functions. These are not just for high-powered operations researchers. Financial mathematical functions range from the common—mortgages, net present value, bond yield to maturity—to the sublime: the saving function. The saving function uses future value, payment, rate, and number of periods. You enter three of the parameters, and it returns the fourth—an impressive feat even for spreadsheets. And there are enough math and statistical functions to keep most statisticians happy, among them ANOVA, bioassay, correlation, clustering, discriminant, factor, life table and product limit, nonparametric, stepwise, and tabulate functions.

I looked up the tabulate function and wrote a brief program in QED to analyze the differences in the buy prices of the PC Labs test data consisting of individual records for buying and selling auto parts. It took less than a minute for *PRODAS* to produce the complete report for a file of 500 records!

PRODAS's wide range of graphs can also help you reduce data into more meaningful information. In addition to the normal bar, pie, line, and scatter graphs, there are open, high, low, close, step, and log-scaled charts, needle plots, and more.

PRODAS has the features to do an excellent job of data analysis and collection, making it of use to marketing, manufacturing, general management, accounting, and other users. Some competing database systems are easier to use for data validation, control, and security, but they do not have the same range of power for analyzing the data once it is collected. In the final analysis, if you believe it is information, not data, that really matters, then you will want to consider letting *PRODAS* go to work for you.—**Timothy J. Lee**

Progress

If I were asked to instruct a class in relational database management, I would hand each student the tutorial and programming handbook that come with *Progress*, a $1,000 DBMS from Progress Software Corp. Including its reference manual, the 3-inch-thick, wire-bound *Progress* documentation deserves four stars, three Oscars, two Emmys and my unending praise: all are that good.

The *Progress* documentation starts by describing the reasons for using a relational database. It continues with on-disk programming examples—every one of which works!—through file, screen, and report design, transaction processing, error recovery, multiuser programming, and database normalization. The author obviously understands the problems of application design in the "real world" and explains not only how to do something, but why one way is better than another.

Progress was created for people who design and manage large, multitable databases linked through multiple relationships. Built into the program are password security on fields and files; transaction backout, plus transaction and roll-forward recovery, which can restore your data files in the event of a hardware error or total hard disk loss; and the ability to distribute large databases among different disks. A data dictionary defines all fields, files, and indexes, along with each field's input mask, default value, mandatory input (yes/no), validity check with error message, help message, and screen or report label. Once you create the individual tables comprising your database and relate them through indexes, you're ready to input and query the data and print reports using the *Progress* language.

PC MAGAZINE FACT FILE



***Progress*, Version 4.2A**
Progress Software Corp.
5 Oak Park
Bedford, MA 01730
(800) FAST-4GL
(617) 275-4500
List Price: $1,000
Requires: 512K, hard disk, DOS 2.1 or later.
In Short: *Progress* is a true fourth-generation development tool featuring a powerful language, automatic error recovery, and transaction processing, all superbly detailed in the excellent manuals. Not copy protected.
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Database commands originate in *Progress* from the full-screen editor, which checks for syntax or field definition errors and compiles and runs your programs—or procedures, as they are called in *Progress*. Any ASCII editor will do; the built-in one is convenient if simplistic. All commands other than those relating to the dictionary or on-line help are given here; there is no screen or report generator, no facility to query by example or form. Remarkably, I never noticed their absence. After spending a day with the tutorial, I was fluently writing procedures that *Progress* turned into tastefully formatted input or output screens and reports. Offered the choice of spending 20 minutes with the typical database screen generator or 5 minutes programming with *Progress*, I'll take *Progress*.

The same holds true for reports. With a dozen lines of code, I created multifile

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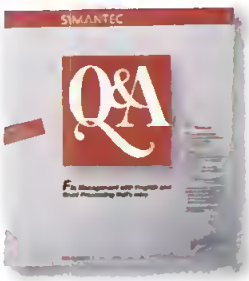
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screen or printed output, including subtotal breaks, crosstabs, and totals. It's possible to create these same reports using other programs' full-screen report generators, but the simplicity and power of the *Progress* commands combine hands-on control with speed of design.

Does all this mean that *Progress* cannot produce colorful screens with pop-up help, or that only an expert can drive it? No, but *Progress* does perform best in the hands of a trained operator.

SCREENS AND PROCEDURES

Screens in *Progress* are called frames, and *Progress* knows how to define the limits of a frame with IBM line-drawing characters, put titles in reverse type, and wait for a keypress when more than one screen of text awaits display. A screenful of fields, formatted as a traditional table, is automatically produced reflecting current definitions in the data dictionary. If you would like to overlay or combine frames, add color, move prompts, or omit the box, a few additional command verbs are enough.

File relations are automatic upon indexing, and *Progress* will create temporary on-the-fly indexes whenever a query demands them. Moving-bar menus are a snap, as are customized help and function-key reassignments. If desired, *Progress* will treat a character array as one long field so that word processing with word wrap can be simulated.

Programming in *Progress* is simply a matter of stringing together procedures until the end result is accomplished. Since the editor checks for errors, compiles, and runs code in one step, testing and execution are easy and fast. I don't want to minimize the problems associated with application development, but the *Progress* language is so powerful that it redefines the work day.

Progress is available for a vast number of computer hardware and operating systems, including 8088, 80286, 80386 machines, VAX and MicroVAX, Altos, AT&T, HP, and others, running DOS, UNIX, Xenix, Ultrix, VMS, and LANs. This impressive variety of operating environments opens the marketplace to developers who can cross-compile their applications and sell to clients running another brand of hardware. I recommend you investigate *Progress* for vertical market applications, corporate MIS needs, or any single or multiuser application that requires guaranteed data integrity; flexible, efficient programming; and a fourth-generation query language. A fully documented trial package (limited only by the number of times you can open a database) is available for $95.—**Mike Friedlander**

(continues)

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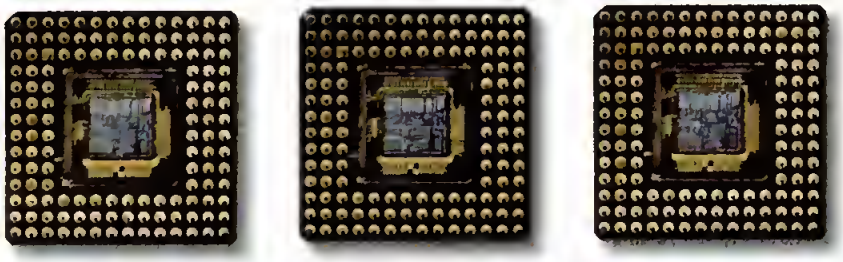
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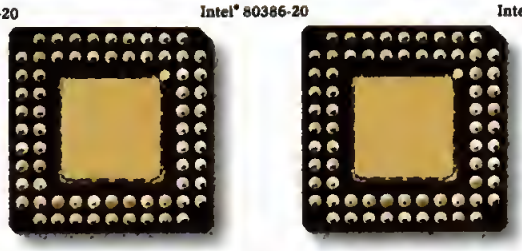
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Similar performance enhancements are engineered into each subsystem of every COMPAQ personal computer. Each component is then optimized individually, yet designed to work as part of the total system.

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CIRCLE 494 ON READER SERVICE CARD

Benchmark Tests: Programmable Databases

Programmable databases, Part 3 of *PC Magazine*'s Project Detabase 3, represent the powerhouses of database management. But despite this distinction, some still stumbled during the PC Labs benchmark tests. Ten of these packages, in fact, could not import 50,000 records within the specified 3-hour time limit.

O'Hanlon, dBASE III Plus, PRODAS. Zim, 1 on 1 = 3!!, and *Advanced Revelation* were able to import the 50,000-record file but failed to finish the 50,000-record report in under 3 hours.

As with the results in the previous two issues, fast times for any given test are important and directly relate to one database product's ability to outperform another.

Equelly important is the comparison o! the times a database package takes to perform one particuler task with two different file sizes. Notice in the Import test, for example, that *DB-Fabs* needed only 63 seconds to Import 5,000 records but required 1,140 seconds for 50,000 records. Ordinarily, well-honed database software should not take more than ten times longer to perform the same function on ten times more records. One exception to this rule of thumb is the Search test: 11 packages ectually took less time to search 50,000 records than to search 5,000 because the search through PC Labs' 50,000-record file passed fewer records before reaching the first one that satisfied the criterie.

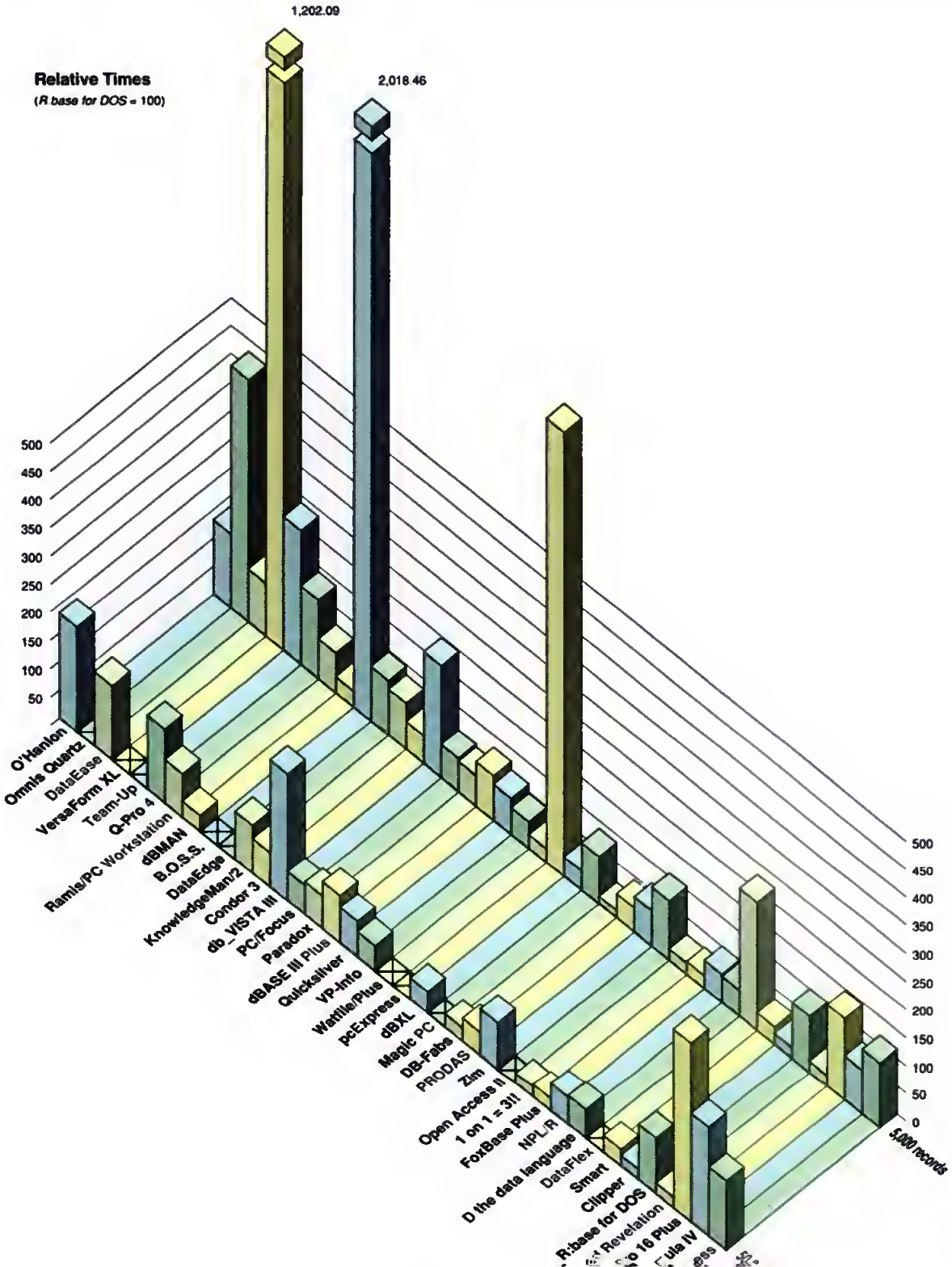
IMPORT

The **Import** test measures how quickly the database can import an ASCII file (of either fixed field length or comma-delimited format) with an index on the first field. We included the indexing portion of the test to avoid penalizing programs that automatically index the first field dunng the data conversion. Some programs required a two-step process for this lest: an import followed by indexing.

Performance Times

(Times given in seconds)	50,000 records	5,000 records
O'Hanlon	8,879.80	594.72
Omnis Quartz	DNF	1,930.20
DataEase	6,341.45	428.36
VersaForm XL	DNF	5,416.50
Team-Up	DNF	1,070.32
Q-Pro 4	6,233.00	630.61
Ramis/PC Workstation	3,620.00	318.00
dBMAN	1,378.00	132.00
B.O.S.S.	DNF	9,095.00
DataEdge	DNF	438.00
KnowledgeMan/2	4,114.90	372.50
Condor 3	2,993.00	224.20
db_VISTA III	10,774.00	891.00
PC/Focus	2,539.46	264.83
Paradox	2,831.10	242.80
dBASE III Plus	4,041.00	352.00
Quicksilver	3,019.61	287.59
VP-Info	2,153.36	216.90
Watfile/Plus	NAO*	114.00
pcExpress	DNF	3,543.00
dBXL	1,862.24	160.26
Magic PC	DNF	387.00
DB-Fabs	1,140.00	63.00
PRODAS	1,965.40	197.18
Zim	3,960.20	284.72
Open Access II	DNF	476.70
1 on 1 = 3!!	904.00	93.00
FoxBase Plus	1,080.00	106.00
NPL/R	2,373.24	228.10
D the data language	2,503.00	213.00
DataFlex	DNF	1,027.00
Smart	1,425.25	140.90
Clipper	938.00	90.00
R:base for DOS	4,781.15	450.59
Advanced Revelation	926.00	94.00
filePro 16 Plus	15,370.00	659.00
Formula IV	9,338.54	360.60
Progress	5,899.00	527.00

DNF = Did not finish within 3-hour time limit.
NAO = Could not accomplish task as defined.
* *Watfile/Plus* could handle only 32,765 records maximum.


Relative Times
(R base for DOS = 100)
1,202.09
2,018.46
500
450
400
350
300
250
200
150
100
50
O'Hanlon
Omnis Quartz
DataEase
VersaForm XL
Team-Up
Q-Pro 4
Ramis/PC Workstation
dBMAN
B.O.S.S.
DataEdge
KnowledgeMan/2
Condor 3
db_VISTA III
PC/Focus
Paradox
dBASE III Plus
Quicksilver
VP-Info
Watfile/Plus
pcExpress
dBXL
Magic PC
DB-Fabe
PRODAS
Zim
Open Access II
1 on 1 = 3!!
FoxBase Plus
NPL/R
D the data language
DataFlex
Smart
Clipper
R:base for DOS
Revelation
to 16 Plus
ula IV
500
450
400
350
300
250
200
150
100
50
0
5,000 records



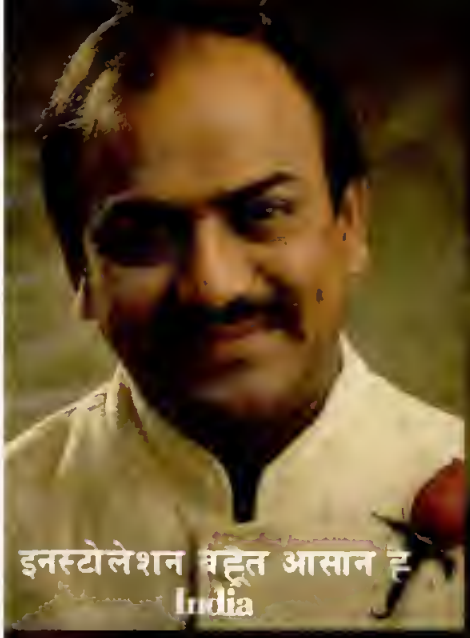
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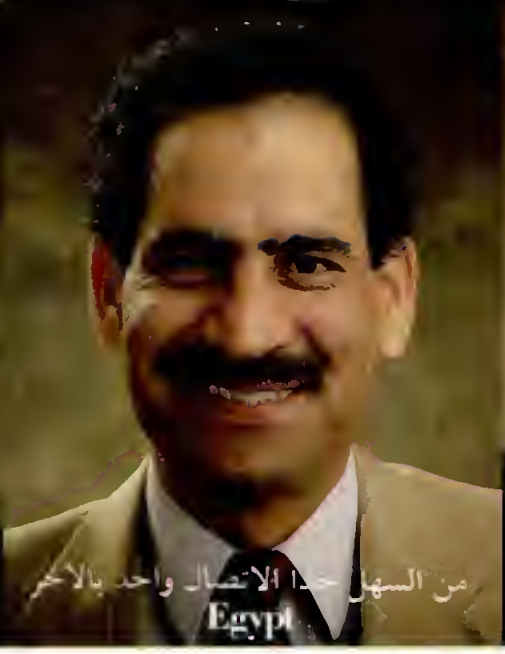
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PC LABS Benchmark Tests: Programmable Databases

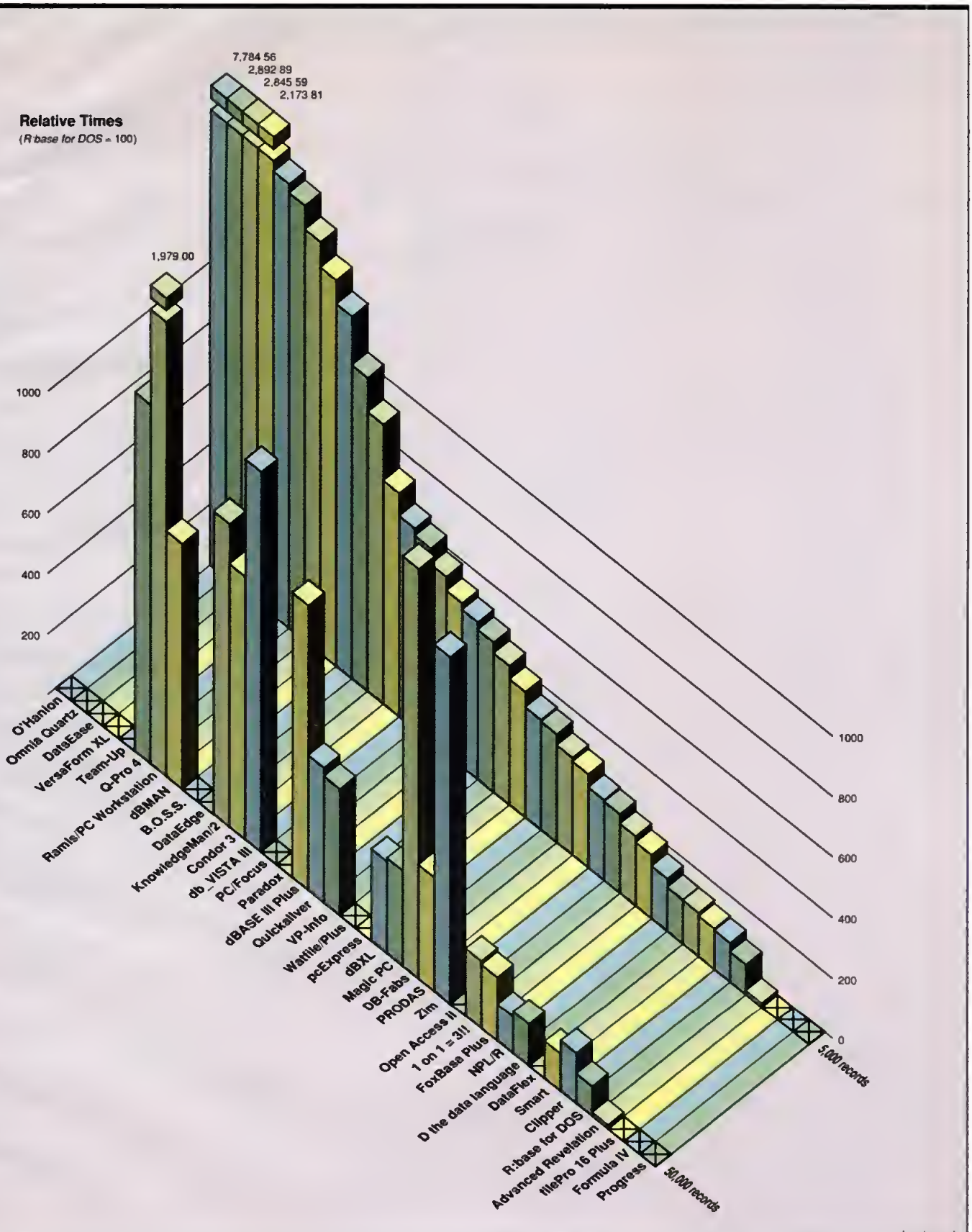
SORT

The Sort test measures the time it takes for the package to sort the files on an unindexed field in ascending order.

Performance Times
(Times given in seconds)

	50,000 records	5,000 records
O'Hanlon	DNF	1,925.90
Omnis Quartz	DNF	715.70
DataEase	NAD	704.00
VersaForm XL	DNF	537.80
Team-Up	DNF	362.43
Q-Pro 4	3,678.00	355.27
Ramis/PC Workstation	6,145.00	336.00
dBMAN	2,515.00	315.00
B.O.S.S.	DNF	295.79
DataEdge	DNF	256.00
KnowledgeMan/2	3,106.80	228.00
Condor 3	2,698.00	182.60
db_VISTA III	3,900.00	164.00
PC/Focus	DNF	158.10
Paradox	IDS	145.40
dBASE III Plus	2,919.00	134.00
Quicksilver	1,384.22	128.75
VP-Info	1,296.74	122.90
Watfile/Plus	NAD*	114.00
pcExpress	DNF	103.00
dBXL	938.85	90.47
Magic PC	975.32	89.15
DB-Fabs	4,200.00	80.00
PRODAS	1,165.13	76.84
Zim	3,557.20	66.25
Open Access II	DNF	65.00
1 on 1 = 3II	700.00	57.00
FoxBase Plus	665.00	52.00
NPL/R	386.56	42.91
D the data language	438.00	36.00
DataFlex	DNF	35.82
Smart	387.22	33.24
Clipper	523.00	32.00
R:base for DOS	310.51	24.74
Advanced Revelation	41.10	3.50
filePro 16 Plus	SOI	SOI
Formula IV	SOI	SOI
Progress	SOI	SOI

DNF = Did not finish within 3-hour time limit.
NAD = Could not accomplish task as defined.
IDS = Insufficient disk space.
SOI = Sorts on index.
* *Watfile/Plus* could handle only 32,765 records maximum.


Relative Times
(R:base for DOS = 100)
7,784.56
2,892.89
2,845.59
2,173.81
1,979.00
1000
800
600
400
200
O'Hanlon
Omnia Quartz
DatsEase
VersaForm XL
Team-Up
Q-Pro 4
Ramis/PC Workstation
dBMAN
B.O.S.S.
DataEdge
KnowledgeMan/2
Condor 3
db_VISTA III
PC/Focus
Paradox
dBASE III Plus
Quickalver
VP-Info
Watfile/Plus
pcExpress
dBXL
Magic PC
DB-Fabs
PRODAS
Zim
Open Access II
1 on 1 = 3!!
FoxBase Plus
NPL/R
D the data language
DataFlex
Smart
Clipper
R:base for DOS
Advanced Revelation
filePro 16 Plus
Formula IV
Progress
1000
800
600
400
200
0
5,000 records
50,000 records

(continues)

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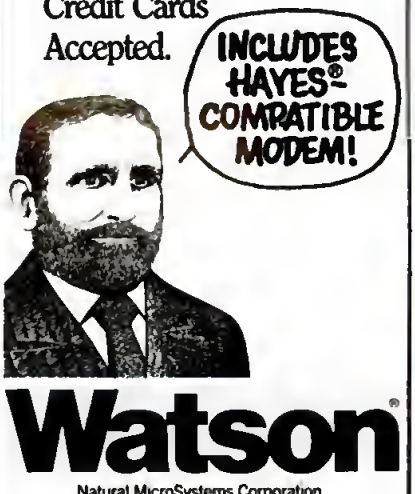
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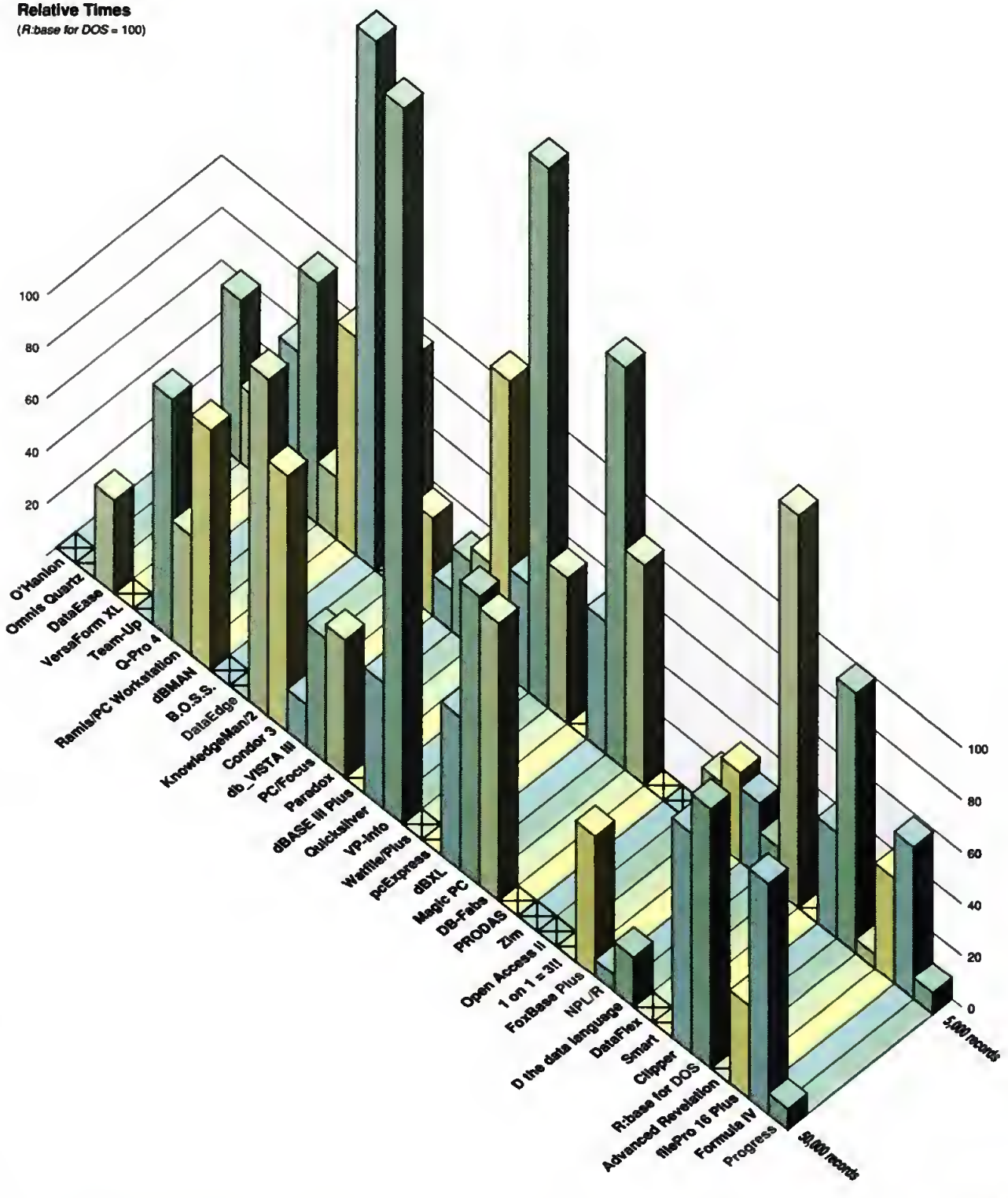
THREE-TABLE REPORT

The **Three-Table Report** test generates a report for those records whose "year" field is equal to 1988 or 1989. The report is made up of 18 fields and is sorted (in ascending and descending order) on 3 of those fields. The test calculates two subtotals and the difference between them at one breakpoint, a subtotal at the second breakpoint, and a grand total at the end of the report. The resulting file is sent to a RAMdisk.

Performance Times

(Times given in seconds)	50,000 records	5,000 records
O'Hanlon	DNF	DNF
Omnis Quartz	DNF	536.00
DataEase	3,250.00	251.95
VersaForm XL	DNF	175.10
Team-Up	DNF	515 89
Q-Pro 4	8,334.00	796 34
Ramis/PC Workstation	4,145.00	205.00
dBMAN	8,335.00	718.00
B.O.S.S.	DNF	1,747.00
DataEdge	DNF	NAD
KnowledgeMan/2	11,705.50	804.20
Condor 3	8,899 00	324 41
db_VISTA III	1,474.00	137.00
PC/Focus	4,311.01	280.60
Paradox	4,794.60	328.70
dBASE III Plus	DNF	978.00
Quicksilver	4,376 01	360 64
VP-Info	24,889.32	1,784.12
Wattile/Plus	NAD*	482.00
pcExpress	DNF	DNF
dBXL	5,311.68	437.75
Magic PC	10,057.11	1,328 14
DB-Fabs	9,638 00	728.00
PRODAS	DNF	DNF
Zim	DNF	DNF
Open Access II	DNF	NAD
1 on 1 = 3!!	DNF	212.00
FoxBase Plus	4,927.00	295.00
NPL/R	603.10	245 55
D the data language	1,759.00	150.00
DataFlex	DNF	1,299.00
Smart	NAD	NAD
Clipper	7,703 00	353.00
R:base for DOS	9,073 97	862.08
Advanced Revelation	DNF	48 50
filePro 16 Plus	3,263 00	353.00
Formula IV	8,077.50	507 94
Progress	730.00	71.00

DNF = Did not finish within 3-hour time limit.
NAD = Could not accomplish task as defined
* *Wattile/Plus* could handle only 32,765 records maximum.


Relative Times
(R:base for DOS = 100)
100
80
60
40
20
O'Hanlon
Omnis Quartz
DataEase
VersaForm XL
Team-Up
Q-Pro 4
Ramis/PC Workstation
dBMAN
B.O.S.S.
DataEdge
KnowledgeMan/2
Condor 3
db_VISTA III
PC/Focus
Paradox
dBASE III Plus
Quicksilver
VP-Info
Watfile/Plus
pcExpress
dBXL
Magic PC
DB-Fabs
PRODAS
Zim
Open Access II
1 on 1 = 3!!
FoxBase Plus
NPL/R
D the data language
DataFlex
Smart
Clipper
R:base for DOS
Advanced Revelation
filePro 16 Plus
Formula IV
Progress
100
80
60
40
20
0
5,000 records
50,000 records

(continues)

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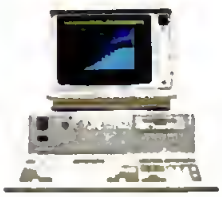
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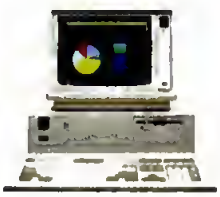
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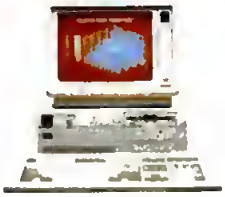
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PC LABS Benchmark Tests: Programmable Databases

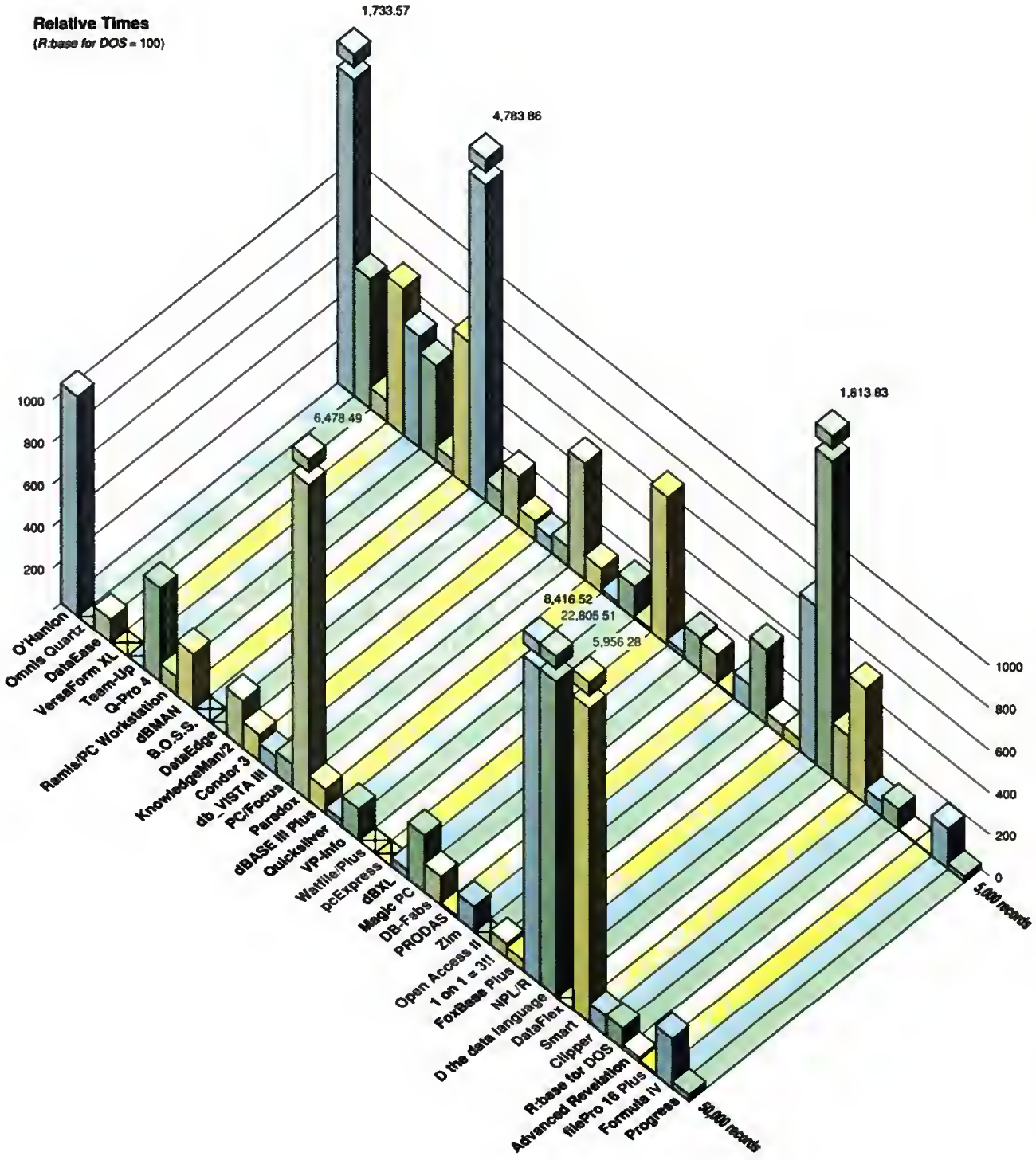
SEARCH

The Search test measures the time it takes to locate the first record that satisfies two criteria (make = Fendhi and model = coupe).

Performance Times

(Times given in seconds)	50,000 records	5,000 records
O'Hanlon	60.70	120.31
Omnis Quartz	DNF	42.80
DataEase	6.44	7.08
VersaForm XL	DNF	48.30
Team-Up	DNF	36.82
Q-Pro 4	25.99	31.59
Ramis/PC Workstation	5.00	5.00
dBMAN	15.00	48.00
B.O.S.S.	DNF	332.00
DataEdge	DNF	7.00
KnowledgeMan/2	13.10	16.70
Condor 3	7.30	6.34
db_VISTA III	5.00	5.00
PC/Focus	6.47	6.43
Paradox	376.40	38.40
dBASE III Plus	7.00	8.00
Quicksilver	1.86	1.38
VP-Info	8.72	10.90
Watfile/Plus	NAD*	1.00
pcExpress	DNF	49.00
dBXL	2.47	1.92
Magic PC	15.87	11.00
DB-Fabs	8.00	10.00
PRODAS	0.72	0.65
Zim	6 93	8 47
Open Access II	DNF	24 60
1 on 1 = 3!!	4 00	4.00
FoxBase Plus	3.00	4.00
NPL/R	489.00	52 03
D the data language	1,325.00	112 00
DataFlex	DNF	17.88
Smart	346.06	37.82
Clipper	5.50	5.00
R:base for DOS	5.81	6 94
Advanced Revelation	1.30	0.40
filePro 16 Plus	0.70	0.40
Formula IV	13.84	13.50
Progress	2.00	2.00

DNF = Did not finish within 3-hour time limit.
NAD = Could not accomplish task as defined.
* *Watfile/Plus* could handle only 32,765 records maximum.


Relative Times
(R:base for DOS = 100)
1,733.57
4,783.86
6,478.49
8,416.52
22,805.51
5,956.28
1,813.83
1000
800
600
400
200
0
5,000 records
50,000 records
O'Hanlon
Omnis Quartz
DataEase
VerseForm XL
Team-Up
Q-Pro 4
Ramis/PC Workstation
dBMAN
B.O.S.S.
DataEdge
KnowledgeMan/2
Condor 3
db_VISTA III
PC/Focus
Paradox
dBASE III Plus
Quickdliver
VP-Info
Watfile/Plus
pcExpress
dBXL
Magic PC
DB-Fabs
PRODAS
Zim
Open Access II
1 on 1 = 3!!
FoxBase Plus
NPL/R
D the data language
DataFlex
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R:base for DOS
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filePro 16 Plus
Formula IV
Progress

(continues)

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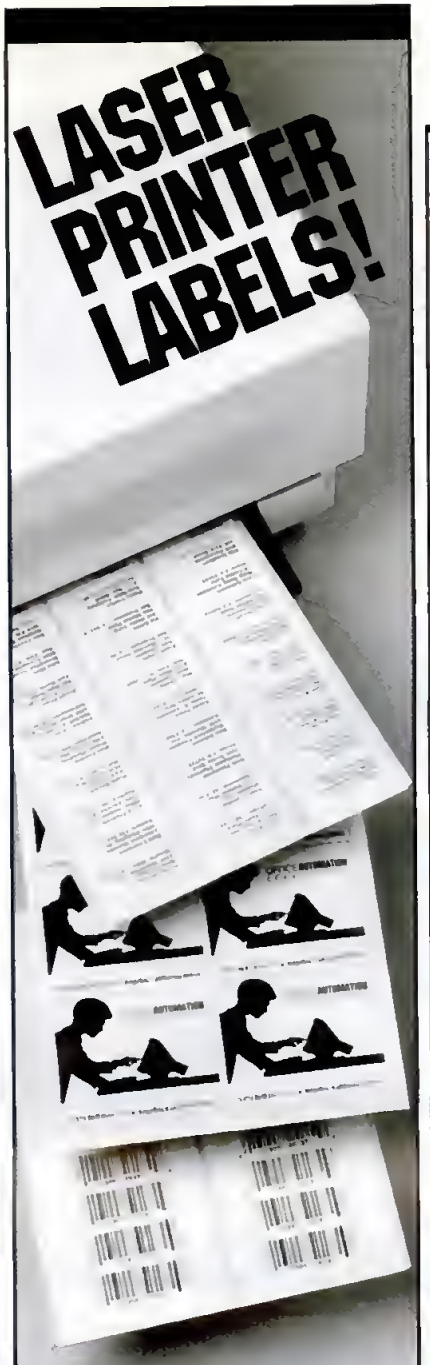
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PC LABS Benchmark Tests: Programmable Databases

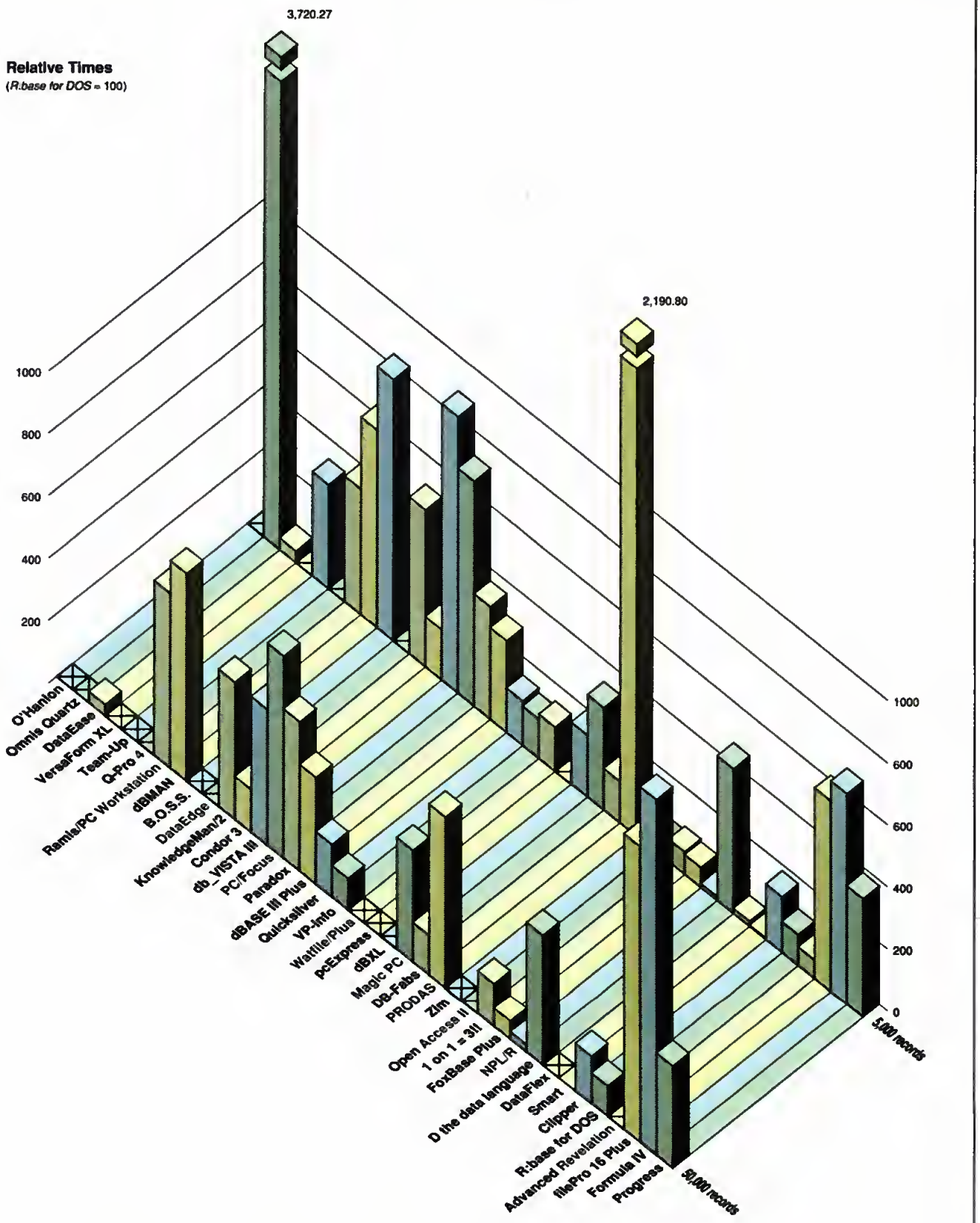
DELETE AND INDEX

The **Delete and Index** (four-column version) test measures the time required to remove four columns (Units, SellPrice, BuyPrice, and TranDate) from a Product table created for this task, and then to reindex the file if necessary.

Performance Times
(Times given in seconds)

	50,000 records	5,000 records
O'Hanlon	DNF	DNF
Omnis Quartz	DNF	2,112.00
DataEase	252.20	21.87
VersaForm XL	DNF	NAD
Team-Up	DNF	189.38
Q-Pro 4	Auto	Auto
Ramis/PC Workstation	3,875.00	229.00
dBMAN	4,609.00	360.00
B.O.S.S.	DNF	475.95
DataEdge	DNF	NAD
KnowledgeMan/2	3,063.30	285.30
Condor 3	973.91	91.41
db_VISTA III	3,041.00	503.00
PC/Focus	4,508.32	408.99
Paradox	3,346.60	204.10
dBASE III Plus	2,401.00	166.00
Quicksilver	1,180.07	80.52
VP-Info	706.63	71.76
Watfile/Plus	NAD*	61.00
pcExpress	NAD	NAD
dBXL	NAD	113.99
Magic PC	2,495.35	167.00
DB-Fabs	885.00	77.00
PRODAS	3,826.49	1,243.72
Zim	Auto	Auto
Open Access II	DNF	34.80
1 on 1 = 3II	964.00	42.00
FoxBase Plus	418.00	37.00
NPL/R	171.87	7.99
D the data language	2,914.00	266.00
DataFlex	DNF	10.00
Smart	3.00	3.00
Clipper	1,068.00	102.00
R:base for DOS	694.68	56.77
Advanced Revelation	NAD	34.50
filePro 16 Plus	6,638.00	349.00
Formula IV	7,978.84	385.76
Progress	2,298.00	217.00

DNF = *Did not finish within 3-hour time limit.*
NAD = Could not accomplish task as defined.
Auto = Function completed automatically or not necessary.
* *Watfile/Plus* could handle only 32,765 records maximum.


Relative Times
(R:base for DOS = 100)
3,720.27
2,190.80
1000
800
600
400
200
O'Hanlon
Omnis Quartz
DataEase
VerseForm XL
Team-Up
Q-Pro 4
Ramis/PC Workstation
dBMAN
B.O.S.S.
DataEdge
KnowledgeMan/2
Condor 3
db_VISTA III
PC/Focus
Paradox
dBASE III Plus
Quicksilver
VP-Info
Watfile/Plus
pcExpress
dBXL
Magic PC
DB-Fabs
PRODAS
Zim
Open Access II
1 on 1 = 3II
FoxBase Plus
NPL/R
D the data language
DataFlex
Smart
Clipper
R:base for DOS
Advanced Revelation
filePro 16 Plus
Formula IV
Progress
1000
600
600
400
200
0
5,000 records
50,000 records

Thanks To The T3200, The Desktop PC Can Now Take Its Place In History.



When the eagerly awaited PC first hit the desks of the public, everyone figured it was there to stay. It was, after all, powerful and functional. And considering it weighed about 40 lbs., it would take a lot to unseat it.

Introducing a lot. The new Toshiba T3200.

In a sleek 19 lb. package, the T3200 acts like no other portable, or overweight desktop PC AT,® for that matter.

With its two internal expansion slots, you can connect to a LAN, a mainframe, or add peripherals.

It also has a 12 MHz 80286 microprocessor, a 40MB hard disk, and a 720KB 3½" diskette drive.



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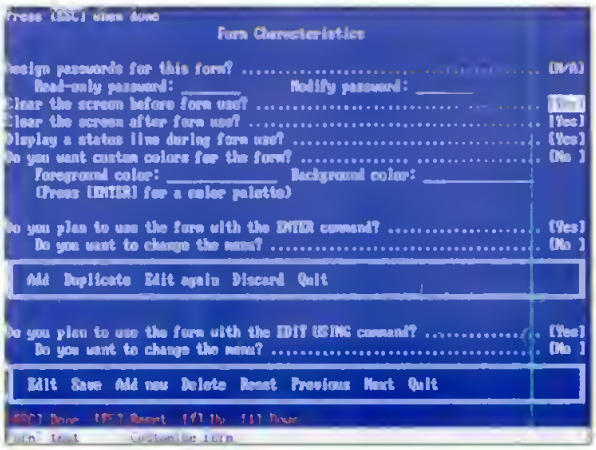
Besides defining the position and attributes of a field, you can link each field to a procedure written in the **Q-Pro 4** *language. The procedure will be executed each time you enter information for that field.*



Pop-up screens are easily summoned in the excellent programmable help system provided by **Quicksilver Diamond Release.** *Here the screen explains the Autonem command's ability to save code lines when initializing field-name memory variables.*



Ramis/PC Workstation *has a menu-driven report generatar that allaws not anly totals and subtatals but alsa averages, counts, ranges, and other functions. An alternative ta the menu is syntax-based reporting (entering nanprocedural cammands in free farm).*



Specifying characteristics af a form ar table is possible while creating a form in **R:base for DOS.** *You can assign passwords, specify regians for creating tiers (which allows multiple processing for many-to-one tables), and customize user options.*

Q-Pro 4

Q-Pro 4, a database and fourth-generation language from Q-N-E International Inc., was first developed to run on 8-bit CP/M machines and was then ported to the PC world in 1983. Five years later, *Q-Pro 4* continues to cover all the bases. Versions of the $595 programming package are still sold and maintained for the CP/M and MP/M operating systems as well as for both DOS and concurrent DOS.

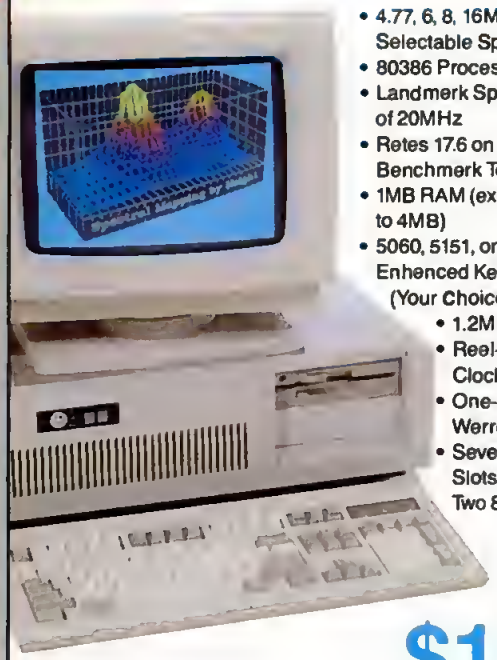
Q-Pro 4 is designed for systems developers rather than end users. Unlike *dBASE*-style packages, *Q-Pro 4* does not have a prompt where you enter commands. Instead, you must execute different programs to create files, screens, and reports. You then use a full-screen editor to develop procedures for building end-user-type applications around these files. Querying is done through an optional program that is available from Q-N-E International.

To install *Q-Pro 4* onto your hard disk, you simply create a subdirectory and copy files into it from a single floppy disk. It's only when you read through a READ.ME file that you discover that several of the files are compressed in an Archive format. Before you can use them, you must uncompress them with a program supplied on the disk.

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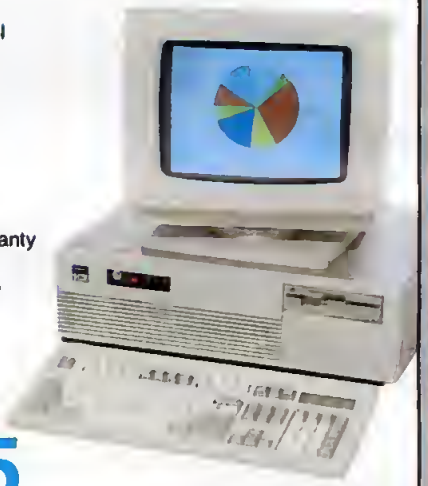
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PC MAGAZINE Editor's Choice Feb 16, 1988

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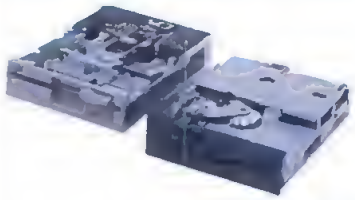
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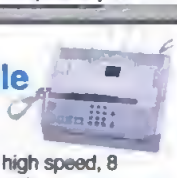
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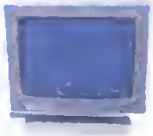
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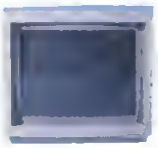
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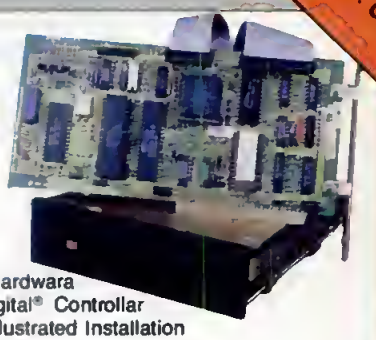


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DEVELOPING APPLICATIONS To begin developing an application, you use a program called FB to create fields and design the data entry screens. In addition, you create procedures in FB using the *Q-Pro 4* language to run custom menus, control data entry, and process the file information. Once the application is complete, you call the *Q-Pro 4* runtime file, QNE.EXE, to execute the procedures.

Q-Pro 4 screens are easy to create. You enter text on one screen and entry field locations on another. By moving the cursor to the desired position and typing F1, you call up a field definition screen, where you enter the field name, its length and screen position, one of several field types, and other format information. To complete the definition, you hit the Enter key. The program then allows you to define another field. Striking Enter twice in succession takes you back to the menu.

To sort your data as you enter it, you must use the menu-driven FID program to define the keys for each file. Since FID needs the field names to create these keys, you must either reenter the field names or use a menu choice to bring them over from the FB file automatically. You can concatenate multiple fields and create many separate keys, all of which will be automatically updated as you enter data. However, the primary key must contain unique values.

After defining files and screens, you must use the *Q-Pro 4* language to write procedures that will open files, capture data, and write data to a file. Using FB's full-screen editor, you enter the *Q-Pro 4* procedures much as you would enter code in a high-level language. Some procedure names have been set aside for special tasks; Load, for instance, automatically executes when the file is loaded. *Q-Pro 4* will branch to the Break procedure when Ctrl-Break is used, to the Error procedure on finding untrapped errors, to the Key procedure when F1 and F10 are used, and to the Enter procedure when you press Return. You can also attach a procedure to a data entry field as you define it.

You can create reports in *Q-Pro 4* by using RG, the report generator, or by writing your own report from scratch in a procedure file. The RG program will report on up to six files, and you can either create a report quickly from the field definition files or enter the information for more-complicated reports. In these reports you create regions for headers, footers, and data. Each region controls column and page breaks and you can even branch to other regions based on certain conditions. Data fields within regions can be added to accumulators, calculated, and tested against criteria for inclusion in the report. RG will even update another file with data from the report.

RICH PROCEDURE LANGUAGE *Q-Pro 4*'s procedure language includes over 100 commands, affording you considerable control over your screens and databases. Each procedure entered in the FB editor starts with a Proc command and ends with the End command. Procedures can call other procedures. Like those of most fourth-generation languages, *Q-Pro 4* commands are powerful and perform many functions at once. For example, the Copy command examines two files for common field names; wherever a match is found, the field entry is copied from one file to another (or to the screen). Q-Pro 4 also includes many network commands and a debug facility.

Q-Pro 4 doesn't exist in a vacuum: Q-N-E International offers utilities to convert *dBASE II*, *dBASE III*, and *Lotus 1-2-3* files into *Q-Pro 4* files. Moreover, the command language can read and write ASCII and comma-delimited ASCII files. *Q-Pro 4* also includes two maintenance programs. One lets you recover damaged files and reorganize files; the other lets you convert text files from your favorite word processor into *Q-Pro 4* procedure files. In addition, the package comes with a setup program that allows you to customize your keyboard and screen and also has an assembly language interface.

The *Q-Pro 4* documentation includes a tutorial, a programmer's reference, and sections on using the report writer, the command language, and the utilities. It is clearly written and contains numerous examples. Despite these advantages, however, even a programmer familiar with conventional database languages may need to go through the tutorial more than once to understand fully how to use this package to full advantage.

■ Once you understand the nuances of *Q-Pro 4*'s programming language, it won't take you long to create a system replete with attractive screens and complex reports.

Although *Q-Pro 4* has come a long way in 7 years, some of its shortcomings reflect its roots in the CP/M world. For example, the procedure editor still uses combinations such as Ctrl-J for a new line (instead of Return) and Ctrl-N for home (instead of the Home key). Pressing Return, rather than Esc or End, ends an editing session. Much of the documentation refers to F0 through F9 instead of F1 through F10. And the programmer interface makes you feel as if you were using an old CP/M machine instead of your PC.

Once you understand the nuances of *Q-Pro 4*'s programming language, it won't take you long to create a system replete with attractive screens and complex reports. *Q-Pro 4*'s toolbox is impressive, but it is strictly for programmers.

—Mike Falkner

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***Q-Pro 4*, Version 4.0**
Q-N-E International Inc.
136 Granite Hill Ct.
Langhorne, PA 19047
(215) 968-5966
List Price: Single-user version, $595; multiuser version, $795.
Requires: 512K RAM, hard disk, DOS 2.0 or later.
In Short: Strictly a programmer's tool, *Q-Pro 4* has a rich procedure language of over 100 commands and a capable report writer. Not copy protected.

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Quicksilver Diamond Release

Quicksilver Diamond Release is a $599 *dBASE* language compiler offering maximum *dBASE III Plus* compatibility and 80 extensions to *dBASE*. Some, like UDFs and For . . . Next, exist in other compilers. Others are unique to *Quicksilver* and are extremely powerful: full windowing, graphs, hooks to desktop publishers, multidimensional arrays, and easy access to DOS disk and I/O services. It runs faster than *dBASE* but slower than *Clipper*.

The program is completely compatible with *dBASE III* databases and indexes. Except for interactive commands (Browse, Modify, and so forth) and a handful of others like Set View and Query, most *dBASE III* programs will run without change using *Quicksilver;* many previous syntactical differences are gone.

By contrast, *Clipper*'s .NDX files were originally incompatible with *dBASE*, preventing the use of both programs together for indexing. Though *Clipper* has been modified to overcome this obstacle, *Quicksilver* is still closer in syntax to *dBASE*. The differences show up in little things; for example, the Display command works without a <fieldlist>.

WINDOWS AND MORE *Quicksilver* does windows! With 17 W-Commands and W-Functions, you can make elegant screens using minimum effort and few commands. In comparison to *Quicksilver*'s riches, *Clipper*'s Save Screen is just a trinket. You can scroll to your choice in a lookup window and pop the selection into the current Get. Coupled with *Quicksilver*'s excellent programmable Help System, the pop-up help screens are easily summoned.

For users with high-resolution displays, these windows can display 43-row by 132-column screens (as long as your adapter provides the DOS driver), so commands like "List Next 43 <exp list>" or "Repo Form <wide-repo>" display correctly.

Quicksilver gives you unusual control over DOS. Set Event detects an incoming signal from a modem or cash register. IN() and OUT() return and send a numeric value to a specified port or device. DOSINT places values in—or receives them from—DOS memory registers. BITSET() shows if a bit is on. HTOI() and ITOH() translate between hex and decimal.

Quicksilver offers two kinds of .EXE file: "d-code" and "optimized." D-code requires two steps, each about as time-consuming as a single compile would be in *Clipper*, Autumn '86. It has automatic memory management (not available after optimization), so that large applications run in 360K of available RAM—without using overlays.

With optimization, a different switch is specified in Step 2, a third optimizing process is run, and the final .EXE file is made with DOS's Link or other (better) linkers like Borland's TLink. As with *Clipper*, only PLink86 supports overlays. (All benchmark tests for this review were optimized.)

The extra compile steps take time. A ten-line program took 36 seconds versus 4 seconds with *Clipper*, Summer '87. Another inconvenience is that *Quicksilver* produces seven .OBJ files for this same short program, truncating your filename if it's over six characters in length, and ending 01.OBJ-07.OBJ.

Feature for feature, *Quicksilver*'s networking system is compatible with the *dBASE* Administrator. It also adds some superb extensions, such as WHOHASIT() (Who owns the lock?), SENSERANGE() (Has data changed?), Send Message (to another user), and Send Task (to an idle workstation). If you can keep your hand out of the cookie jar, *dBASE III Plus* and *Quicksilver* can execute simultaneously on the same LAN.

On the other hand, if you issue the command Set Autolock On, *Quicksilver* will automatically attend to mundane tasks like RLocking a record before a Replace or Read. In many cases, single-user code will execute successfully on a network without further ado.

NOTEWORTHY TEST RESULTS In *Quicksilver*'s Text Update benchmark test, all occurrences of one color were Replaced; *Quicksilver*, however, replaced the first record, disregarding the For condition. A call to the folks at Wordtech confirmed the problem and won a promise to correct it in the next version. Caveat Version 1.2 emptor!

■ *Quicksilver* does windows! You can make elegant screens using minimum effort. In comparison, *Clipper*'s Save Screen is just a trinket.

Though not SQL-based, *Quicksilver* produced the first three tasks of its two-level Select test quite easily. Unfortunately, though *Quicksilver*, *Clipper*, *dBASE*, and *dBXL* can LIST from related files, only fields in the primary database are accessible with Copy. So to produce the output, we Listed to an intermediate text file and Appended its contents into a new database before indexing. We used the same approach for "Natural Join."

And we found few shortcuts in testing *Quicksilver*'s reporting facility. Since the program doesn't support multiple parent/child relationships, this report was not as simple as relating the three test files and running a Report Form with subtotals. In *dBASE III Plus*, there is a slick workaround wherein a virtual relationship can

PC MAGAZINE FACT FILE



***Quicksilver Diamond Release*, Version 1.2**
Wordtech Systems Inc.
P.O. Box 1747
Orinda, CA 94563
(415) 254-0900
List Price: $599; MS-DOS Libraries, $79; Networker Plus, $99 (license for one LAN).
Requires: 384K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: This program offers the highest *dBASE III* compatibility among compilers (including indexes and networking) plus true windowing, UDFs, arrays, and graphs. It is built for comfort, not for speed.

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be set (see Power User, *PC Magazine*, August 1987), but in Version 1.2 of *Quicksilver* (and in *dBXL*), this only succeeds when every key in the primary file also exists in the middle file.

Since this wasn't the test scenario, we created a temporary sales file including dummy keys from the costs file. Though the final report contained the correct information, it took extra steps and time to produce.

Except for networking, Wordtech's interpreter, *dBXL*, supports all of *Quicksilver*'s extended features, including user-defined functions. The combination of these two products is especially handy.

With its many powerful capabilities, plus *dBASE* compatibility and an outstanding symbolic debugger, *Quicksilver* will be of interest to buyers for whom maximum execution speed is not a requisite. **—Brad Stark**

Ramis/PC Workstation

In the PC world, *Ramis* is a name that you won't hear as often as *dBASE;* but among IBM mainframe users, *Ramis* is recognized as a useful database tool. For the PC, On-Line Software International (OSI) offers *Ramis/PC Workstation*, a package that includes a programmable relational database, a report generator, and a communications package. A fourth product called the workstation manager serves as an umbrella for the other three. Together, they link the disparate worlds of experts and novices, mainframes and micros.

AMPLE MENUS The menu-driven structure of *Ramis/PC Workstation* will appeal to novice users, enabling them to accomplish tasks such as creating a file or setting up file relationships, views, or reports. To create a file, you paint the data entry screen first and then go back and define the attributes of fields via menu selections. You can require the field to be filled, establish valid ranges, request table lookup validation, set defaults, and cause fields to be incremented or decremented automatically—all by selecting the appropriate menu choices. A file can have up to 20 screens for input.

The expert will find the menu structure cumbersome though not limiting, thanks to *Ramis*'s command procedure mode. Almost every menu allows for the creation, modification and execution of command procedures to accomplish a complicated or frequently used series of commands. Command procedures can be built through menu selections or through the command mode, which allows you to type commands in directly. Command procedures can be named and commented on, and they can chain to other command procedures. Thus, the sophisticated user can set up routines to be executed by a novice through a simple menu selection. Turnkey systems can be developed as well, so that the end user will see a custom menu developed by the expert.

> ■ Command procedures in *Ramis/PC Workstation* can be chained. Thus the sophisticated user can set up routines to be executed by a novice through a simple menu.

If you intend to build an application with *Ramis/PC Workstation*, be forewarned that there is no memo field type and that the largest size of a character field type is 75 bytes. There is also no tutorial (although one is planned for a future release, along with support for LANs, OS/2, and SQL). If you are new to using database packages and don't have access to an expert, expect to climb a steep learning curve.

Offsetting the lack of a tutorial is the support that OSI offers. The company's toll-free number is prominently and frequently displayed—and before you need to place that call, the context-sensitive help will answer a lot of questions.

Each product comes with its own user guide and is packaged in a three-ring binder and box. The documentation and examples are clear, and the installation of the seven diskettes is straightforward. Regional user groups composed of mainframe users also serve as support.

MANIPULATING THE DATA Transaction processing will allow you to define Compute sets that name formulas and Case logic that specifies which fields must match or not match before a transaction is processed. You can establish start and stop records; include, update, or delete matching records; and store these transaction specifications for repeated use as command procedures.

Via the File Maintenance menu, *Ramis* will allow you to handle such relational manipulations as combining two files with the same record definition, projecting fields from specific records in two files to a third, deleting records in one file based on their occurrence in another, and so forth. Menus or command procedures will help you set up the file relations, conditions, and specific manipulations. You are required to use unique field names (except for linking fields). A package that offers this level of sophistication should allow you to include filename specifications in connection with a field reference the way *dBASE* does with File->Field naming conventions.

The report generator is much more flexible than that of *dBASE*, not only in terms of the report's layout but also the calculations executed and displayed in it. For in-

FACT FILE



Ramis/PC Workstation
On-Line Software International Inc.
2 Executive Dr.
Fort Lee, NJ 07024
(800) 526-0272
(201) 592-0009
List Price: $495

Requires: 512K RAM (640K recommended), hard disk, DOS 2.1 or later.

In Short: A PC-based version of a popular IBM mainframe–based package, *Ramis/PC Workstation* is a sophisticated menu-driven relational DBMS suited to large offices where users of varying skills need access to the same data. Not copy protected.

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stance, in a file containing monthly sales figures for each sales representative, the following commands will create a report showing the largest sales value per person each month:

```
TABLE
NOTE CENTER AT TOP OF PAGE
'FIRST QUARTER ANALYSIS'
'LARGEST SALES VALUE'
'PERMONTH AND PERSON'
SKIP LINE
FILE SALEDATA
SUM MAX VALUE WITHIN SALESREP
AS
'LARGEST SALE,WITHIN MONTH,PER PERSON
CE FLOAT
BY MONTH DISPLAYED NITH MAX VALUE
    WITRIN MONTH CE FLOAT
AS 'LARGEST SALE,WITHIN NONTH'
BY SPNAME AS 'SALESPERSON'
IF MONTH IS LESS THAN 8304
END
```

You can also include averages, counts, ranges, percents, weighted averages, and even standard deviations and variance functions. You can create reports using either the menu structure or "syntax-based" reporting, which allows you to enter nonprocedural commands free-form, as in the example above.

One of *Ramis*'s strong points is that it recognizes the existence of other products. Not only will it import and export *dBASE*, *Lotus 1-2-3*, *Word*, and *WordPerfect* files, among others, but it also has a communication link that will let you connect your PC to IBM mainframes. Applications written with the *Ramis/PC Workstation* can be translated and run on an IBM mainframe.

The ideal environment for *Ramis* is one where the micro and mainframe worlds need to coexist together and where users are at various levels of expertise. While *Ramis* won't please all of the people all of the time, it will come as close as any product to satisfying the needs of most.

—Kate Emery

R:base for DOS

Last year Microrim upgraded *R:base 5000* with the release of *R:base System V*, endowing it with over 150 commands and functions and in the process adding a number of features that enhanced the program's power and flexibility. This year's upgrades, *R:base for DOS* ($725) and the soon-to-be-released *R:base for OS/2*, include even more enhancements, such as an SQL implementation, a pseudocompiler, and a less-cluttered user interface.

■ *R:base for DOS*'s designers completely rewrote the code from FORTRAN into C. As a result, the package is smaller and much faster than previous versions.

Like its predecessors, Microrim's *R:base for DOS* is based on separate modules for database definition (Definition Express), forms creation (Forms Express), report generation (Reports Express), and applications (Applications Express). Other modules include FileGateway, an extremely elegant import/export module (among other things, it places rejected records in a bucket and then allows you to edit and add them); RBEdit, a simple but effective text file editor; plus Codelock and Developer's Express, two pseudocompilers.

The user interfaces range from the enigmatic command line for power users, to a query-by-example mode that interactively builds executable commands, to menus for novices. Features include the usual relational database commands (select, browse, join), operators (equals, contains, fails) and functions (average, max, min), as well as cross-tabulation and supermath functions, and provisions for rules, security, and view creation.

Through its Express modules for forms, reports, and applications, *R:base for DOS* provides users with a vehicle for creating and maintaining a sophisticated database without the need to write extensive code.

Among its many strong points, *R:base for DOS* lets you designate rules to which input values must adhere, or create a data entry field that interactively looks up values from another table for consistency. You can record and play back command statements, define macros, and customize any application for security, prompts, and esthetics. (Most of these features were available two releases ago, in *R:base 5000*.)

SQL Among the PC DBMS market leaders, *R:base for DOS* is the first with a viable SQL implementation. Although Microrim's implementation does not have all of the features of the better-known SQL-based products, such as *Informix*, *Ingres*, or *Oracle*, it is robust enough for many PC-based SQL applications.

In all, 15 SQL commands and keywords have been added to the package, including Create and Drop Index, Declare, Fetch Cursor, Grant, Revoke, Group By, Distinct, Between, and In, though most of these were already functionally available within *R:base*'s proprietary language. The implementation lacks commit and rollback commands. You cannot nest more than one subselect per command, nor can you designate columns for processing by prefixing them with their table names (as in PRODUCT.TRANID, where PRODUCT is the table name and TRANID the column name).

Executing the PC Labs benchmark tests

PC MAGAZINE FACT FILE



R:base for DOS
Microrim Inc.
3925 159th Ave. NE
Redmond, WA 98052
(206) 885-2000
List Price: Up to three users, $725; up to six users, $995; network, $2,695.
Requires: 512K RAM, hard disk, DOS 2.0 or later
In Short: *R:base for DOS* is an elegant and flexible relational DBMS that offers both a command line and a prompted query-by-example mode for end users and a host of generators for application developers. It differs from *System V* primarily in its faster performance and SQL implementation. If you are looking for a powerful DBMS but don't want to be tied to a consultant, *R:base for DOS* could be the answer. Not copy protected.

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*Suggested Retail Price

presented few surprises. While we executed most of the commands with the SQL implementation, we had to alter some of the command statements, but no more than in other SQL-based programs. For example, because of the implementation's inability to include functions within the nested subselect, we had to compute the average, store it within a variable, and then execute the rest of the command.

We didn't run the PC Labs SQL three-table Union and the Natural Join tests because of the package's inability to select columns by name and its limit of two tables per union. Although we could have run the union either in two steps—performing a union on two tables at a time—or by using pointers, the results would not have been comparable with those for other packages, since other SQL-based DBMSs do not impose the two-table-per-union limitation.

Someone will argue that the SQL commands are but window dressing since *R:base System V* already had much of the same functionality and syntax. However, the addition of SQL's data manipulation language commands and keywords enables you to use the same code for *R:base* that you would use for a minicomputer or mainframe SQL-based DBMS, with a minimum of alteration. You will also be able to take advantage of any third-party development tools or add-on programs that are developed for SQL.

IMPROVEMENTS The most notable improvement is the elimination of separate .EXE modules for the *R:base* engine and the various Express modules. *R:base*'s designers accomplished this by completely rewriting the code from FORTRAN into C. As a result, the package is smaller and responds much faster than did previous versions.

Microrim also revamped *R:base*'s main menu. Rather than displaying a screen of commands and command categories, *R:base for DOS* displays a menu of eight selections that eventually leads you to the individual commands. (Microrim has not altered the prompt-by-example mode or the excellent on-line context-sensitive help.) While the new menu means that you must strike an additional key before you can reach a command, it should make the program more accessible to less experienced users.

Switching from the command-line mode to the prompt mode is a simple matter: just hit the Esc key. Any command you execute in either mode is saved in a buffer and can be recalled for execution. The command history is wiped out, though, whenever you come out of one of the original Express modules, such as Forms or Applications Express.

Also new is *R:base*'s automatic optimization feature, which enables the program to decide which of four sort algorithms (in-memory, data, pointer, or B-tree) to use for sorting, view processing, or cross-tabulation commands. In making its determination, the program takes into account the amount of available RAM, the number of rows and columns, and the availability of keys.

Although Microrim does not provide a compiler, it does include two program modules—Codelock and Developer's Express—that create binary files from ASCII command files and enable the application to execute quickly. Developer's Express is a pseudocompiler that speeds if-then and while-endwhile block processing by 30 percent.

DRAWBACKS Although *R:base* is a standard-setter among PC DBMSs, it does have its faults. One of them has to do with the file size and the ability of the program to redefine the database. When we attempted to remove four columns and pack a three-table database (a total of 100,000 records) of over 10MB (with approximately the same amount free) using the Remove command at the command line, *R:base* did not issue a syntax error message but attempted to execute the command and ran out of disk space. You can, however, remove more than one column through the RBDefine module because it reclaims the space after each column removal.

Another design problem has to do with the "Count EQ Last" pointer. It seems that if you delete the last row, the pointer is reset to the first row and it will remain there until a new record is added or the database is packed.

Despite these two faults (which Microrim is in the process of correcting), *R:base for DOS* is still one of the best PC-based DBMSs on the market. It offers unparalleled flexibility and user friendliness, and its overall design is elegant. While *R:base for DOS* is not perfection, it is pointing the way.—**Vincent Puglia**

The Smart Data Base Manager

The Smart Data Base Manager is powerfully smart and full-featured, too, despite its status as a mere $695 module of an integrated package. *Smart* is a direct descendent of *T.I.M.*, Innovative Software's BASIC language database, and it offers the earlier program's best attributes in a sleek, speedy C environment. Also added are many relational features and a modern user interface.

The *Data Base Manager* can be integrated with *The Smart Software System*'s spreadsheet, graphics, word processing, and communications modules. And *Smart* can be installed either as a single-user system or on a LAN. It's got a nifty though verbose programming language, substantial hardware support, built-in security

PC MAGAZINE FACT FILE



***The Smart Data Base Manager*, Version 3.1**
Innovative
Software Inc
9875 Widmer Rd
Lenexa, KS 66215
(800) GET-SMART
(913) 492-3800

List Price: *Data Base Manager* only, $695; *The Smart Software System*, $895.
Requires: 256K RAM, two disk drives, DOS 2.1 or later.
In Short: *The Smart Data Base Manager*, which is one part of an integrated package, holds its own against the top database contenders. *Smart*'s assets include its menu system (which facilitates custom screen design), its ability to store complex predefined queries, and its powerful project processing language. *Smart*'s inability to perform relational or reporting functions on more than two files is its chief limitation. Not copy protected.

CIRCLE 659 ON READER SERVICE CARD

measures, and marvelous custom screen creation.

To run the program, you first install part of the *Smart* system, including telecommunications module, time manager, and project processing language. The *Data Base Manager* itself comes on one disk, with tutorials and sample files available on a second.

The plentiful documentation is indicative of the heavy-duty reading that lies ahead. You'll often find yourself jumping between two major volumes—one for the *Smart* system, another for the database module—to put the pieces together.

READY TO GROW *The Smart Data Base Manager* is designed to let out its seams as you grow, with different "confidence levels" allowing selective access to menus and functions. In its simplest form, the program is entirely menu driven and offers five command lists that are invoked individually.

From this point, command entry modes are graded. The numbered menus can be bypassed with quick function-key or Alt-Ctrl-key commands. You can issue single-word commands from a barebones prompt. A macro function lets you store any series of keystrokes as a single key. And the programming language lets you abandon menu controls altogether and write comprehensive database routines.

Smart help is omnipresent. A single-line Auto-Help displays a brief context-sensitive command synopsis. Pressing F1 invokes a lengthier help screen, and pressing it again summons a full-screen help menu.

Database creation is a breeze. You define a file by answering a few basic prompts regarding structure, location, and password status, and then specifying field types and lengths. Besides alpha, numeric, and calculate field definitions, there are built-in defaults for a sequential counter, as well as inverted name, phone number, and Social Security fields. Noticeably missing from an otherwise well-stocked selection is a "currency" field.

Most helpful is the ability to define a new database file or database screen quickly, based on "matching" or "similar" database files or screens. Custom screens can provide selective data views, and *Smart* allows nine custom screen definitions per file.

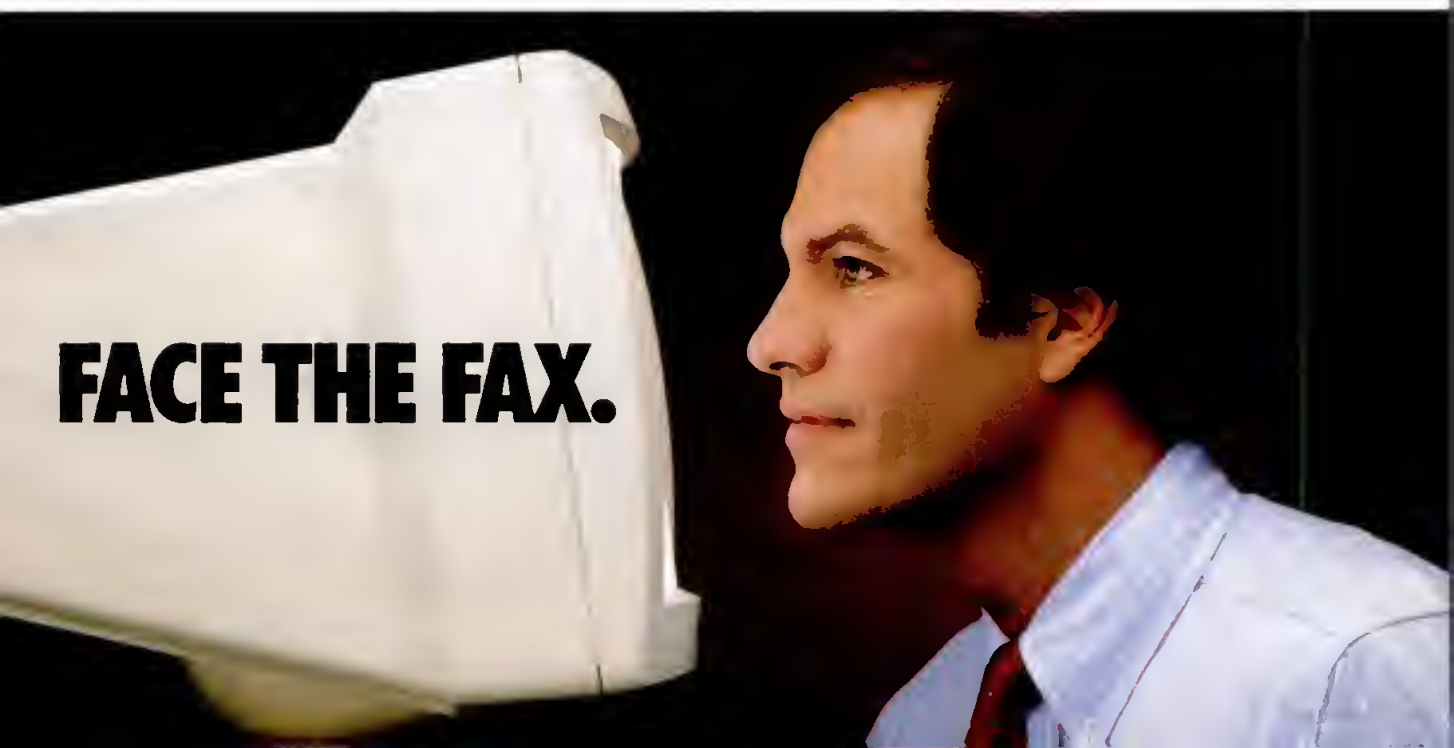
Database files can contain 15 keyed fields each; a single key can contain multiple major and minor fields. The documentation states that keys (unlike sorted or queried fields) are maintained as you update records. This, however, is misleading: you must manually update your file after modifying the contents of a keyed field.

A few extra steps thrown into the indexing procedure add some confusion. A *Smart* index is a nonphysical reference file that can be created during a sort or query condition. An Order command asks you to specify whether to view a file based on sequential, keyed, or indexed files. But the Query and Sort functions can also be stored as indexes—and in order to have them work properly, the file must first be ordered. If there's a discrepancy between the Order command and the predefined index, you'll need to go back to the Order command and reorder.

Smart is flexible and lets you view data from many different perches. Besides trying record-by-record retrieval, you can "browse" on all or certain fields to see a screenful of records at once; you can scroll; and you can use a GOTO or a fast though limited Find command.

Query, the real flagship command, performs counts on selected records, does global updates and modifications, and more. Departing radically from the menus, a full-screen query editor lets you define a query using a syntax-dependent formula expression. Once defined, the query can be named, saved, and reused.

TWO AT A TIME To work with multiple files, you must load all the files being used; multifile operations are limited to



two files at a time. A handful of commands let you create a nonphysical link between database files. For example, Link lets you tie two files together by a single field. Lookup retrieves data from one and inserts it into another, and Transaction posts records to one file based on input to another.

The Relate command allows for a physical join, intersect, union, or nonintersect of two files. While you may prefer to use the Link command to avoid surrendering the disk space required for a physical relation, Link is unable to afford the same versatility in creating new data relationships. If you need to relate more than two database files, look at other database solutions.

Smart is popping with windows, but it could manage them better. You're allowed as many as 25 on-screen at once. Each can house a different database file or screen, but the windows are only labeled Window 1, Window 2, and so forth. (Keeping track of what's in a window without a filename is like storing spices in unlabeled bottles.)

The report writer is the least attractive part of the program since it's useless for multifile reports. You can choose either a table or a free-form format for presenting your data, and you're given a series of prompts for defining the report page. Neither report format is especially well prompted or intuitive.

The only multifile report accommodated is a hybrid with one file using a table form and one using the free format—ideal for creating such printed materials as invoices but not for reporting on two linked files. And the only aggregate function available for the entire file is a grand total.

USING THE LANGUAGE Whatever can't be done through the program's commands can be done with the project processing language—but only if you're willing to learn yet another programming language. The basis of creating a program here is the Remember mode, which signals *Smart* to start, finish, edit, or compile the program. Once Remember is invoked, all your commands are recorded.

We used this language for a report linking three databases and found that it forced us to move in small, often awkward steps. The fairly straightforward reporting task—which required only a few lines of code in similar programs—needed 186 lines here. *Smart* lets you create complicated programmable procedures, but it's difficult because of the language's rigid and idiosyncratic syntax.

I like *The Smart Data Base Manager* because of its ability to create and define complicated queries easily and its multiview perspective of data in any given file. If you never deal with more than two files simultaneously, you'll find *Smart* has everything you could ask for in a database and more.

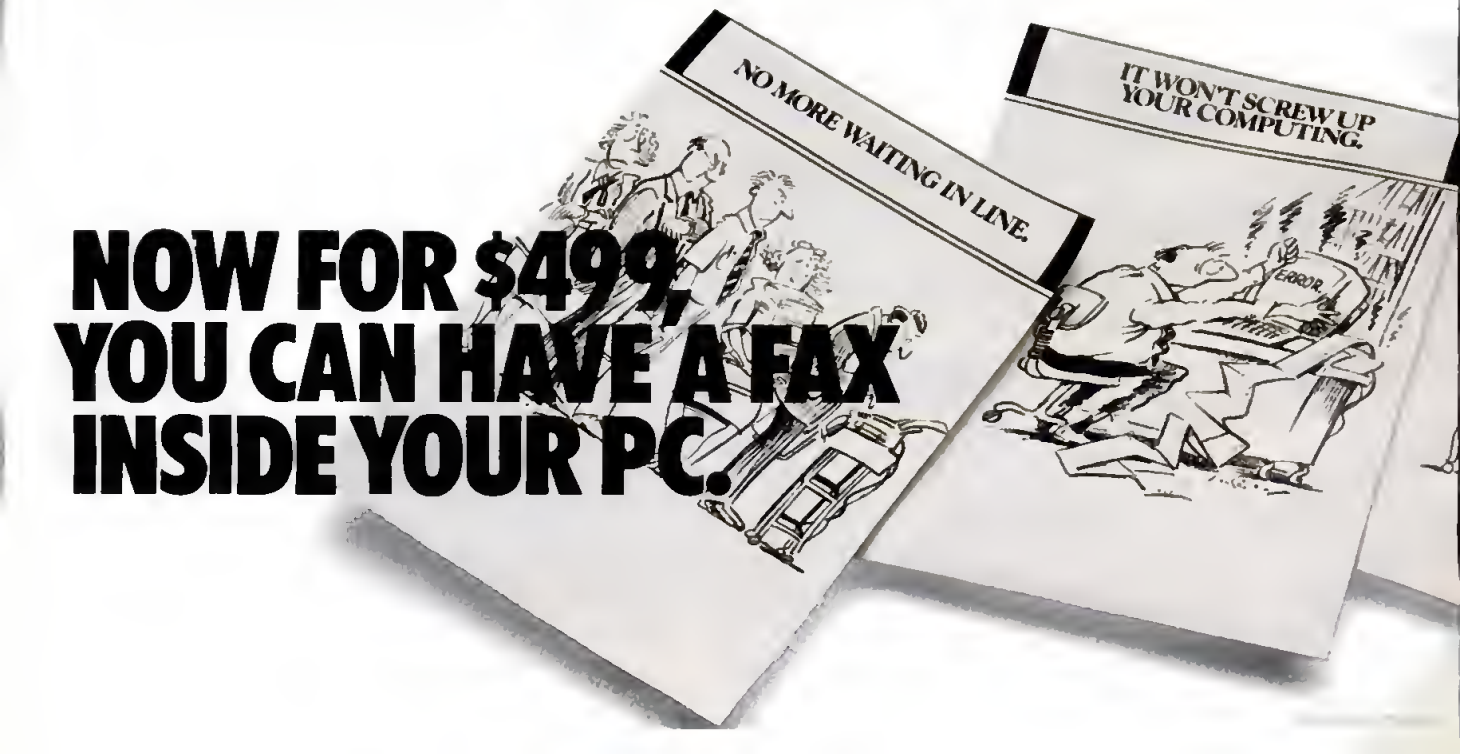
Unlike many integrated-package modules that skimp on functionality, *Smart* holds its own when compared with most leading standalone databases. While a single product is never perfect, it's obvious that *Smart* is no dummy.—**Robin Raskin**

Team-Up

Each chapter divider in the *Team-Up* manual has a soft, pencil-drawn illustration. These maroon drawings give the documentation a friendly, almost homespun feel. But they are like decoy ducks nestled on a pond surrounded by hunters, because the manual turns out to be dense reading. Luckily, the manual is not the program. *Team-Up* itself is friendly but not simplistic. Priced at $795, Unlimited Processing's package is a powerful and superbly flexible approach to managing data.

The outer structure of *Team-Up* is a menu tree. The first layers of menus lead you to different functional areas of the program; the following menus lead to specific operations. To move through the menus, you can type the number of your choice or highlight it with the cursor keys and then press Return.

You can also make the same initial maneuvers by typing a path code, which is a



number that reflects the menu tree sequence. For example, 1.4.4 will invoke the Reindex command. Using the path codes is naturally much faster than hopping through menus. The most frequently used path codes are listed on a pocket reference card and are easy to remember.

Below the menu structure, some commands are initiated by typing the command's first letter or highlighting its name with the cursor keys. In the Access Data area, commands are entered with Ctrl-key combinations. For example, to find a particular record you would enter the appropriate field values and then press Ctrl-F.

Another command tool in the Access Data area is *Team-Up*'s procedural language. It is similar to Pascal but does not have callable procedures. With the procedural language (PL), built-in text editor, and compiler (under Evaluate PL on the menu), you can write routines for simple tasks, like global updates, or for complex applications, like multiple business accounting systems. The PL enables you to define mathematical operations, update records, join files, and write reports across as many as 255 databases. The procedural language gives *Team-Up* incredible power and flexibility, but it does exact a price in learning time.

All programming languages feel awkward at first. *Team-Up*'s language is no exception, yet the commands are English-like. Most are listed on the program reference card, and all are explained thoroughly, along with the language syntax, in a 147-page section of the manual. There is also a "pick-and-choose" language editor that automatically enters syntax and commands, but it is limited to simple mathematical operations and won't allow relationships to be formed among files.

DATA DISPLAY The Access Data section of the program is where most of the action occurs. Here you enter, retrieve, change, and delete data. There are two types of data display: full screen and "one-liners." The full screen is a full record, or at least the first page of a full record. Each record can have up to 255 pages.

The one-liner screen appears automatically when a search scores more than one record. It is a row-and-column view of the records—one record to a line and 20 records to a screen. The one-liner will hold only 73 characters of information, with one space between fields. So by setting the character length, you get to choose how many of the first several data fields are displayed. If you move the cursor to the record you want to see and press Enter, the full record appears on the screen.

A simple three-character command allows you to sidestep the one-liner screen and see the first record of a multiple find. Subsequent "hits" are retrieved by pressing PgDn. This is another instance of *Team-Up*'s flexibility.

Searching is done with the straightforward, query-by-example technique. You enter an exact value or part of a value in a blank field. You can also use up to nine

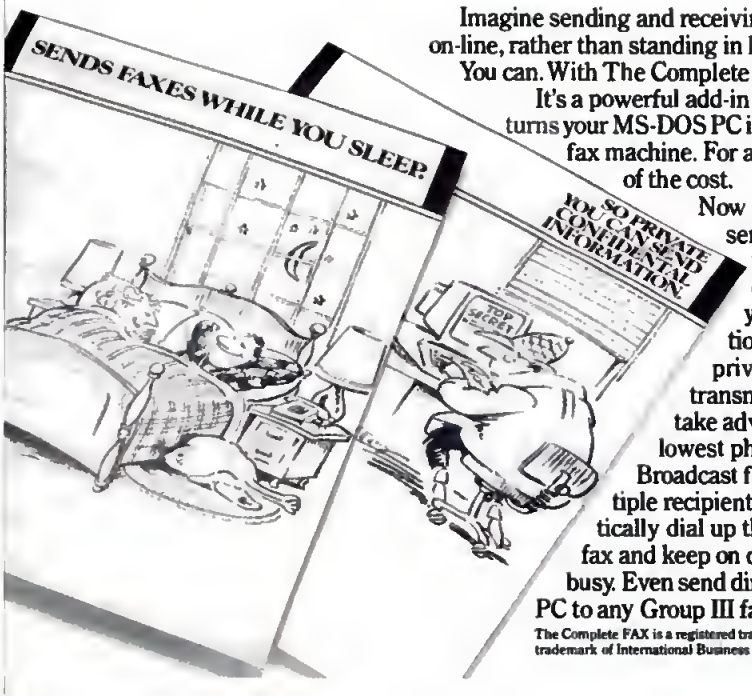
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***Team-Up*, Version 2.0**
Unlimited Processing Inc.
8382 Baymeadows Rd., #8
Jacksonville, FL 32216
(800) 874-8555
(904) 731-8330

List Price: $795; multiuser version, $1,795.
Requires: 140K RAM, hard disk drive, DOS 3.1 or later (3.2 recommended).
In Short: An extremely easy-to-learn programmable hierarchical DBMS. All of the basic database operations can be invoked through menus or Ctrl-key combinations, yet there is also a procedural language for customizing operations or writing more-complex applications. The only flaws are a slow import facility for large files, a dense manual, and some old-fashioned syntax in the procedural language. Not copy protected.

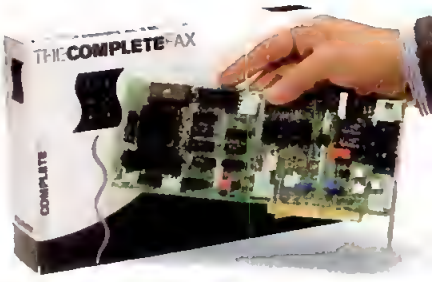
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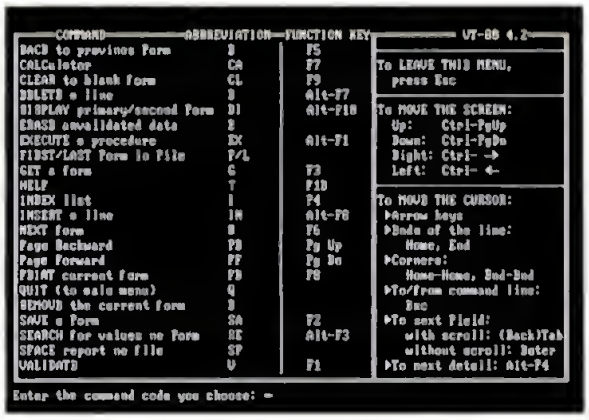
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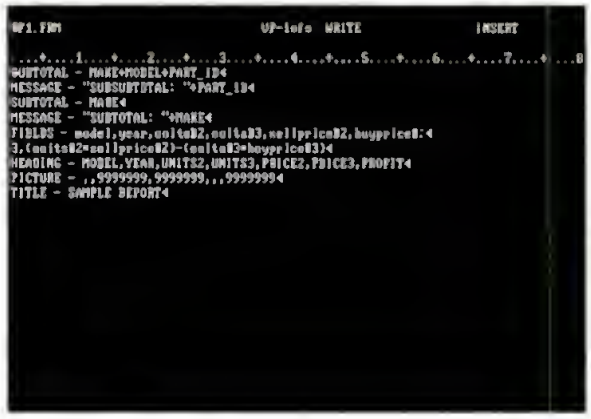
Using **The Smart Data Base Manager***'s Relate command, you specify the files and the field with which you want them linked. The program can perform relational functions on only two files.*



Along the first line, **Team-Up***'s report body screen displays all fields included in the report. The first field, highlighted in red, is a formula; the actual formula appears near the bottom of the screen.*



Although there is little on-line help in **VersaForm XL**, *this screen is available whenever a data entry form is displayed; it lists various commands and their functions. Note that many of these commands are also assigned to function keys for speedier access.*



VP-Info*'s limited report writer uses a text file to specify the report layout and up to two subtotal levels; to create more-sophisticated reports, programming is necessary. Keywords like Field, Heading, and Title control the format of the report.*

qualifiers, including GE for *greater than or equal to*, LT for *less than*, MP for *match phrase*, NL for *null*, and NN for *not null*. The contents of up to 20 numeric or money fields can be totaled during a search; results are displayed on the one-liner screen.

Database records are designed by typing field names wherever you want them on an open screen and indicating field [illegible] can also define other field attributes, even the colors they should be displayed in. To make definition easy there are help screens for every aspect of the process.

When you are done designing the records, *TeamUp* prompts you to "enlarge" the database—that is, to open up record space. You can set the number of records you expect to have if you're importing [illegible] ning these routines is also necessary after changing a database—depending on how it is altered. Once started, the routines are automatic.

REPORT DESIGN PLUS Like *TeamUp*'s other portions, the report section is easy to master. The Report Design menu is divided into four sections. By jumping [illegible]



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pulled. The procedure is so intuitive that you hardly need to consult the manual. And the reports you can generate are as rich and varied as your imagination.

Team-Up has a host of other abilities. Two of the most important are a good but slow import/export facility and in-depth security.

You can import or export both ASCII and .DIF files. But from a speed of almost 500 records per minute, the rate degrades to just over 165 records per minute for a 50,000-record file.

Security is embedded in the program from top to bottom. With passwords you can restrict access to groups or individual users and limit entry to menus, functional areas, and even data fields.

With all its abilities, *Team-Up* is still an easy program to learn because it's studded with menus, functional prompts, and automatic routines. The programming language takes time to master and has some old-fashioned syntax, but it isn't cryptic. So *Team-Up* is an excellent program for users who want power and flexibility without a struggle.—**Henry Fersko-Weiss**

VersaForm XL

Remember your first car? How you had to jiggle the gas pedal just so to get it to start in cold weather? How nobody else could get it into reverse without grinding gears? It had its idiosyncrasies, but it got you where you wanted to go and it was cheap. The same is true for *VersaForm XL*.

Applied Software Technology positions *VersaForm XL* as a database tool for developing custom accounting and financial applications. Priced at $159, *VersaForm XL* is among the least-expensive packages reviewed in this issue. For this low price, you get a program that comes with a complex procedural language, a host of built-in functions, and the ability to relate multiple tables.

VersaForm XL also comes with a feature that eliminates multiple tables in many applications. It has special multiline fields, similar to the detail lines on an invoice. These fields can be totaled on-screen and used in a variety of reports. As its name suggests, the program is especially suited for filling out forms like invoices and statements.

Installation is easy and straightforward; you can copy the files from the three distribution disks to a subdirectory on your hard disk. You do not need to configure the program to run it, although there is a main menu option that lets you change the default settings.

You then create a file definition at the same time as you "paint" a data entry form with a full-screen editor. *VersaForm* is remarkably flexible. You can specify field names that contain spaces, and you define the field length simply by placing the appropriate number of periods following the field name. After you define the single fields, you must select one to contain a unique key field; *VersaForm* will not accept multiple records with the same key value.

Unlike the case with many programs, you do not need to specify what type of data a field will hold. You may add requirements to a field definition, such as those for numeric or date information. *VersaForm* can also require a check digit on a numeric field, which can be used to improve data entry accuracy for items such as part numbers. (The program also includes a command-line calculator that can be accessed during data entry and can be used to calculate valid check digits for numeric values.) Fields can also be defined as the result of such operations as calculations or table lookups.

After the single-field items are defined, you can create columns of multiline fields. These fields can be given the same types of attributes as the single-item fields.

At this point, you are ready to enter and search through your data. If you want reports, or if you want to conduct a complex lookup and verification among tables, you will need to use procedure files. If you are going to import data, you will also need to write procedures.

PROCEDURE PROCEDURES Procedures are created on a screen that is essentially a *VersaForm* record, with a header that indicates the procedure name and any secondary table that may be used with it, followed by detail lines that contain the procedure commands. The language syntax closely follows Pascal, but if you are comfortable with using While and If-Then-Else statements, you should be able to pick up the details rather easily.

You can see 16 lines of code at a time. Before you can scroll to the next screen, you must "validate" the code by pressing a function key. This action provides a cursory check of the data for plausible entries. Once you complete the procedure, you save it with another function key. This compiles the procedure so that it can be used with your data files. In the process, *VersaForm* error-checks the entire procedure and will give you an error message if it finds anything wrong. You can continue to save the code—mistakes and all—and fix it later, or you can reenter the editor and amend it right away.

Because the first part of the PC Labs benchmark tests involves the importing of ASCII data files, I plunged into procedure writing from the start. I discovered (from the manual) that *VersaForm* works more easily with fixed-length records. I discovered the hard way (by not seeing it in the manual) that import variables are limited to 80 characters, so I had to divide the data reads from the ASCII file into two steps and then use substring functions to place the data in the appropriate fields. The resulting import was slow, primarily because *VersaForm* works hard at updating the index every time a record is added.

VersaForm comes with sample procedures on which you can model your own,

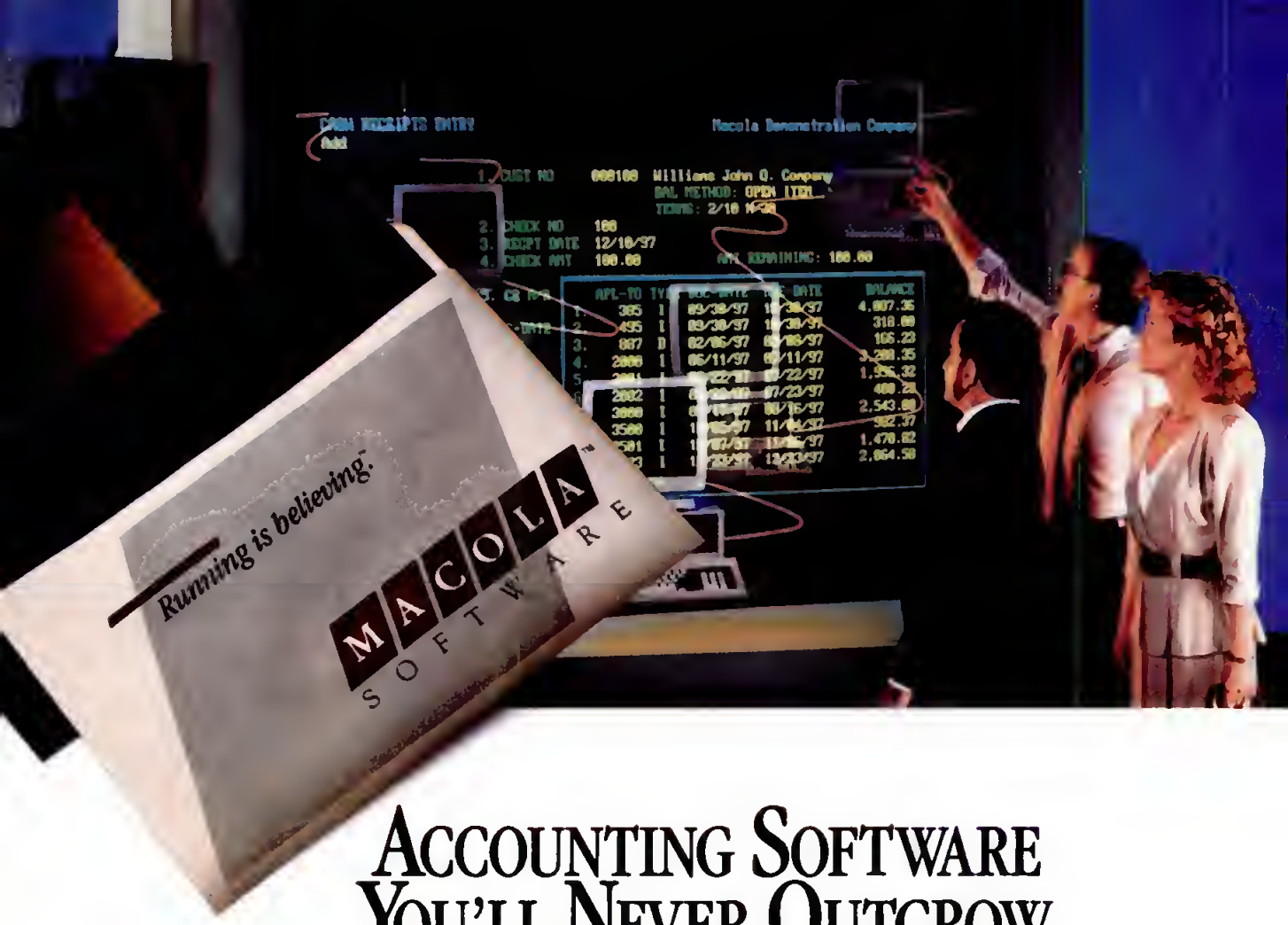
PC MAGAZINE FACT FILE



VersaForm XL, Version 4.2
Applied Software Technology
P.O. Box 397
Los Gatos, CA 95031
(800) 678-1111
(408) 370-2662

List Price: $159
Requires: 512K RAM, two disk drives or hard disk, DOS 2.1 or later.
In Short: Among the lowest-priced packages reviewed in this issue, *VersaForm XL* offers a host of features, including a procedural language, numerous built-in functions, and the ability to relate multiple tables. Shortcomings are its less-than-elegant command line and inconsistencies in its documentation. Not copy protected.

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CIRCLE 263 ON READER SERVICE CARD

so writing successful procedures is not too difficult. Its editor is limited, however. It has no block functions, and you can only insert or delete lines one at a time.

USER INTERFACE *VersaForm*'s user interface reflects its venerable history, which dates back to 64K computers. For example, its command line is less than eloquent:

```
Command (?(help),V,G,SA,SE,N,B,CL,E,
PF,PB,D,IN,PR,R,I,CA,DI,SP,Q):
```

(This appears as one line on the screen.)

Fortunately, the latest version helps by assigning some of the most-frequently used commands to function keys, and there is an adequate on-line help screen.

The manual has an adequate index, but there are some holes. The screen images in the manual do not always match the display, and some information is hard to find. For example, when referring to a field name that contains a space in a procedure, you must precede and follow the name with exclamation points. This information is buried in a note at the end of a chapter, and the only index reference is under "!"—with the wrong page cited.

In spite of these shortcomings, *VersaForm XL* represents a reasonable value. You get a lot of power for $159. In turn, you must get by without a polished or verbose user interface, and you must restructure some of your design ideas to fit the program's constraints and assumptions. If you need to develop turnkey applications on a budget, *VersaForm XL* is worth a look.
—Alfred Poor

VP-Info

Take *dBASE II*, add a rich array of new features that rival and sometimes surpass *dBASE III PLUS*, lower the price to $124.95, and what do you get? *VP-Info*.

VP-Info is a relational database marketed by Paperback Software International, which believes that software should be priced based on its manufacturing costs, not its perceived value.

Installing *VP-Info* is a snap: on a hard disk, just copy the program into the desired directory. Once it is loaded, the screen displays a command line—similar to that of *dBASE*, except that it replaces the familiar dot prompt with a I> that signifies the first of six active work areas available. *VP-Info* can link up to six databases using the Set Relation command.

The program can create, read, and write data files in the same formats used by *dBASE II* and *III* as well as its own unique format. Its index files are compatible with *dBASE II* formats but not with those of *dBASE III*. *dBASE II* users can easily trade up to *VP-Info*'s powerful programming language without having to convert their existing data and index files. And if you're looking to convert *dBASE II* data files to a *dBASE III* file format, you could use *VP-Info* to read records selectively from a *dBASE II* file and write them to a *dBASE III* file.

VP-Info's maximum file size is 65,535 records, the same as that of *dBASE II*. Its practical limit may be smaller if you're indexing your database on multiple fields. During the test, we noted an inverse relationship between the number of records in the database and the size of the index key allowed. Using the 500- and 5,000-record databases, a 36-character index key (Make + Model + Part_ID) was allowed. With the 50,000 records, we were forced to reduce the index key to 21 characters.

If you plan on using databases with 5,000 records or less, this limitation will not be a problem. But if your databases exceed 5,000 records, with index keys between 20 and 30 characters, you could be in for trouble as your database system grows.

Defining a database file is accomplished with the Create command. It looks just like the Create command in *dBASE III Plus*, but unfortunately it doesn't support Date and Memo field types. The cursor movement keys available during the Create session, in fact, are so bad that you'll be wondering whether someone is playing a cruel joke on you. In general, the cursor movement keys used throughout the program are inconsistent. Sometimes *VP-Info* follows a *dBASE/WordStar* convention; at other times it follows its own.

POWERFUL PROGRAMMING *VP-Info* features a powerful structured programming language with WHILE, CASE, and IF statements. Anyone experienced in using other structured programming languages (like Pascal and FORTRAN) will find it simple and easy to learn.

Inexperienced programmers will have a difficult time coming up to speed, since *VP-Info* does not use a menu-driven front end like those found in *Paradox* or *dBASE III Plus*. Three commands that rival *dBASE III* and merit mention are Menu(), On Field, and Window.

The Menu() function instantly converts a list of choices into a light-bar menu. To select a menu item, move the cursor to the desired item and press Enter.

The On Field command performs validation routines to verify or look up information as each entry is made. A powerful tool, it will enable programmers to reduce the amount of code that typically goes into error trapping.

And *VP-Info*'s built-in Window command will allow your program to "pop up" information from files or display help messages for operators.

VP-Info has a built-in on-screen editor that allows you to create and modify command files. Experienced programmers will love its ability to mark, move, and copy blocks of text. In addition, it has an autoformat feature that capitalizes *VP-Info* commands and automatically indents WHILE, IF, and CASE statements. This makes it easier for you to program in a structured format with nested statements.

PC MAGAZINE FACT FILE



***VP-Info*, Version 1.4**
Paperback Software International
2830 Ninth St
Berkeley, CA 94710
(415) 644-2116
List Price: $124.95
Requires: 256K RAM, (384K recommended), two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: *VP-Info* is a powerful, high-speed database management system that has data file compatibility with both *dBASE II* and *dBASE III*. Designed for users with programming experience, its non-menu-driven format, coupled with confusing error messages, may hinder the efforts of other users to come up to speed quickly. Not copy protected.

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VP-Info comes with a very good manual and an excellent on-line help facility. Typing Help brings up a menu-driven help facility that lists *VP-Info*'s commands and functions. If you need help with a particular command and do not want to wander through the help menu, you can type Help followed by the command name. In case the manual and on-screen help facility are not enough, *VP-Info*'s technical support staff is friendly and competent.

CONFUSING MESSAGES As good as these are, *VP-Info* could do a better job when it comes to error messages. During our test we received messages that either had a double meaning or were not detailed enough to help find the problem.

When using the Run command to execute a DOS command, for example, we received the following message: "Command not found or not enough space to execute. (See Set Memo To)." Which one is it? We tried using Set Memory to increase the memory available, but still received the same error message. Was there still a memory problem or was something else wrong? Without more-specific error messages, debugging your *VP-Info* program will take a significant amount of extra time.

VP-Info's report generator is slightly better than nothing at all. Report forms are created in *VP-Info*'s text editor, and key words like Field, Heading, and Title are used to control the report's format. The report generator can be used for basic lists with up to two subtotal levels. More-sophisticated reports must be programmed.

■ *VP-Info* would be a terrific package were *dBASE III Plus* not available.

VP-Info lacks a screen generator, but it does offer a Text command that lets you define screen output in a program file, on the fly, without having to figure out screen coordinates.

VP-Info is designed for those with programming experience. Its report writer, screen generator, query facility, and general data manipulation system are not menu driven. However, applications programmers will find *VP-Info*'s programming language powerful and flexible. It would be a terrific package were *dBASE III Plus* not available. But with *dBASE III Plus* as the industry standard, and with the advent of *dBASE IV*, *VP-Info*'s time may have passed before it ever came.

—Michael Alesandro and Allyn Vineberg

Watfile/Plus

Priced at $395, *Watfile/Plus* from Watcom Products is a fairly powerful program with lots of features, designed specifically for end users rather than for professional programmers. *Watfile/Plus* was not intended to compete with the likes of *dBASE III Plus*, but was built on the assumption that the people who use it to set up data management systems will be the same ones who use the files.

Watfile/Plus can be used on a PC with one floppy disk drive. To use it with a hard disk, just copy the program files from the single floppy disk to any subdirectory; they'll take up 284K of memory. The installation process does not change your AUTOEXEC.BAT or CONFIG.SYS files. You can change setup or display parameters while running the program by using the Configure command, and you can reset the program defaults in the same manner with little fuss.

One key to the program's approachability is its dual-level design. You only have to use a subset of the *Watfile/Plus* commands—referred to as the kernel, to define files, add and modify records, perform simple calculations, and save or print the current table. When the kernel functions no longer suffice, advanced commands or operations are available for working with multiple files, splitting files, and creating command files. On-line help provides information about all commands. The first 170 pages of the manual are a tutorial, with more hand-holding for basic commands than for advanced functions.

Most *Watfile/Plus* operations are controlled by simple English commands such as "SORT year" (to reorder a file based on the values in the year field). The program also uses function keys and Ctrl- and Alt-key combinations. And there is a Memorize command that can record a series of commands to be invoked later as a macro.

RELATING IN THE WORKSPACE All activities in *Watfile/Plus* take place in a "workspace." After you've finished creating, adding to, or editing a file in the workspace you can save it on disk. You can sort or index files, change field types, globally update text and numeric fields, delete fields, combine information from other files, and create workspace-only calculated fields without ever affecting the files on disk until you save the new file from the workspace.

Files to be related must have one identical field and must each be indexed on that field. To work with both files, you first bring one file into the workspace and then use the command "COMBINE *filename fieldname*," with *filename* the name of the second file and *fieldname* the common field by which both files are indexed. When files are combined, fields in the second file that aren't in the first file are added to the workspace, and the values in fields that are in both files are changed to the values in the second file. Another command, Merge, also brings two files together, in-

PC MAGAZINE FACT FILE

WATCOM

***Watfile/Plus*, Version 3.0C**
Watcom Products Inc.
415 Phillip St.
Waterloo, Ontario,
Canada N2L 3X2
(519) 886-3700
List Price: $395

Requires: 192K RAM, one disk drive, DOS 2.0 or later.

In Short: A good choice for beginners. *Watfile/Plus* lets you start simply and use advanced features only when you need them. *Watfile/Plus* is not a programmer's development tool but a good personal filing system for small applications where the designer is also the user. Not copy protected.

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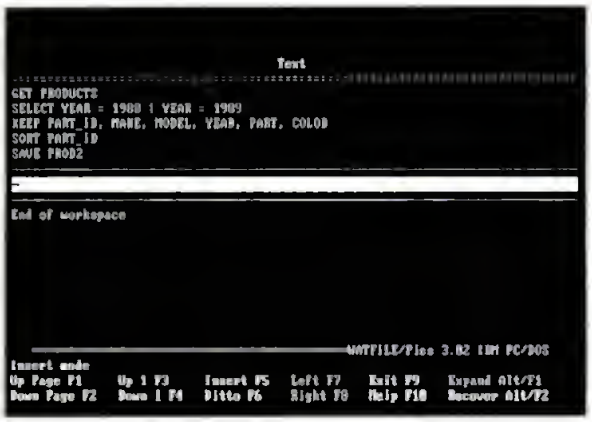
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Writing command files is easy using **Watfile/Plus***'s English-like programming language. By typing the command Insert when the workspace is clear, you enter a text mode that features a full-screen text editor.*



Once you have created an entity set in **Zim**, *you can browse or list the members of that set by using such commands as List, Locate, Next, and Previous.*

terleaving them in key field order without replacing values. Only two files can be open at one time, but you can continue to merge or combine files until you have the data you need.

Watfile/Plus includes an easy-to-use full-screen editor for creating and modifying command files. If you type the command "Insert," the command-file-editor screen comes up, and you can enter and edit successive command lines. Lines longer than the screen width can be continued by ending with an ampersand (&). *Watfile/Plus*'s programming language includes conditional commands and lets you set up custom entry screens and reports. Command files are saved with their own eight-character names and later invoked with the command "Perform *filename*."

A set of configuration commands lets you control the way the program runs. One option, called parallel processing, runs program files faster with certain combinations of commands than if the commands are executed sequentially.

TARGET USERS *Watfile/Plus* is not for applications developers. The limitation of 32,766 records makes it inappropriate for large applications, and with our 32,765-record sample test file the times for all operations except querying were unacceptably slow.

The vendor is accurate in identifying *Watfile/Plus* users as those who want a personal system for small files. *Watfile/Plus* lets you change your mind any time in the process of setting up or using a database with a minimum of fuss. And if your needs grow beyond the program's capabilities, data can be output in ASCII or delimited format for importing into other systems.

At $395, *Watfile/Plus* is a bit expensive as a beginners' system, but its ease of use, graceful design, and smooth method of introducing advanced features (such as multiple file operations and command files) make it a fine choice for self-sufficient users who need to peform small-office filing tasks.—**Bruce Brown**

Zim

In its advertisements, Zanthe Information welcomes prospective users of its *Zim* fourth-generation language/database management system to the "world of serious 4GL/DBMS programming." Designed for applications developers, the $880 package addresses the serious issue of applications portability, allowing you to move your PC-based database applications to such operating environments as VM/CMS on mainframes, VAX/VMS on DEC minicomputers, and UNIX and Xenix on various machines. Runtime systems are also available.

Zim handles export and import of data for a variety of formats. Data can be accessed from text editors, spreadsheets, and other databases for use in a *Zim* file—with an ASCII dump necessary for *Lotus 1-2-3* and *dBASE* data. When exporting, many systems will accept *Zim* files; .DIF-format files can be generated as needed.

A workmanlike product that gets the job done, *Zim* uses the entity set to model relationships among elements in the database. *Zim*'s use of this approach distinguishes the package from most other DBMSs, including traditional relational systems.

BUILDING A SET In *Zim*, each record is considered to be a single entity; an entity set, as its name implies, is a group of single entities. To build an entity set, you tell *Zim* which entities are to be included and how they are related. You then give that entity set a unique name, which you use whenever you want to access the entities (records) in that set.

If it sounds like you can use the entity set as a filter, that's exactly right. For example, if you wanted to further refine a particular entity set by grouping together certain records that belonged to it, you would do so by calling up that entity set and then defining and naming a second en-

EDITOR'S CHOICE

- **FoxBase Plus**
- **Paradox**
- **R:base for DOS**

In Project Database II (June 24, 1986), Ashton-Tate's dBASE III Plus *was singled out as the DBMS all others would have to measure up to. Cited for the many new features it added to that series of database management products (including an interactive query mode, improved report generation facilities, expanded error trapping, and debugging capabilities),* dBASE III Plus *was easier to use and more powerful than its predecessors. But in the 2 years since* PC Magazine*'s last roundup, the DBMS market has seen many changes, among them the rise of a successful cottage industry dedicated to producing* dBASE *tools, the appearance of* dBASE*-compatible software that either has advanced the state of the art or is priced well under* dBASE*, and the introduction of more PC-based programs that use SQL.*

What hasn't changed—but is about to—is dBASE III Plus. dBASE IV*, a renamed, revamped, and revitalized version, is scheduled to make its debut in late July. Incorporating both improvements and enhancements,* dBASE IV *will offer complete relational capabilities, a full implementation of SQL (both interactive and embedded), a more-powerful user interface, and a pseudocompiler, as well as many other new features.* PC Magazine*'s examination of the beta version shows that had the final code been available for review,* dBASE IV *would have been a very strong contender for Editor's Choice.*

Of the dBASE *compatibles,* FoxBase Plus *from Fox Software offers speeds up to six times as fast as* dBASE III Plus. *But* FoxBase *surpasses* dBASE III Plus *in other significant ways, most notably in its extensions to the* dBASE *programming language. Experienced* dBASE *users and applications developers will find useful such additions as user-defined functions and memory variable arrays, and such amplifications as a command that will allow multiple database relations per file, plus the ability to open 48 files simultaneously and to include 128 procedures in a Procedure file.*

When it was chosen by PC Magazine *as one of the best products of 1987, Borland International's* Paradox*, Version 2.0, was called "the thinking user's DBMS," both for its intelligent file- and record-locking capabilities as a multiuser/network product and for its usability as a standalone program. Indeed, that appellation befits this product, which successfully combines a Lotus-like menu and command system and the query-by-example approach.* Paradox *is different from most other programmable DBMSs in its application of table views and its division of certain tasks into multiple steps; it may take some time to adjust to but its rewards are many.*

A lot has happened to Microrim's R:base *since* R:base Series 5000 *was selected as an Editor's Choice in Project Database II. Taking exception to the adage "They also serve who only stand and wait," Microrim released* R:base System V *last year and* R:base for DOS *this year, in the process heaping enhancement upan enhancement and solidifying its inventory of application-building tools. Microrim's efforts during* dBASE*'s dormancy paid off:* R:base for DOS *beat* dBASE *to market with an implementation of SQL, a pseudocompiler, and a less-cluttered user interface. A powerful package for both end users and applications developers,* R:base for DOS *is one of the best programmable DBMSs you'll find.*

tity set for those selected records. At the same time that you issue commands to define and name the new entity set, you can include operators that will define the index keys.

From the resulting entity set, you can create more entity sets. Anyone who has used the Filter command in *dBASE III Plus* and has waited for it to crank through a large database (especially when it must be executed each time the same routine is run) will appreciate the value of the entity-set approach.

PROGRAMMING LANGUAGE While the entity set structure is beneficial (most notably in creating recursive links and many-to-many relationships), *Zim*'s programming language is the key to the power of this package. Extending over several lines if necessary, commands include expressions that can adeptly combine complex arithmetic, conditional and Boolean operators, and *Zim* commands.

Zim also allows you to generate fully formatted reports using a set of report commands; these commands, stored in a *Zim* document, can be modified with a text editor. Report options govern position and appearance of data plus headers, footers, and summary information. A Mask format option defines a masking pattern (character, number, or date value) for a report item.

FACT FILE



***Zim*, Version 3.0**
Zanthe Information Inc.
1200-38 Antares Dr.
Nepean, Ontario
Canada K2E 7V2
(800) 267-9972
(613) 727-1397
List Price: Single user. $880; up to four users, $1,495.
Requires: 640K RAM, hard disk drive, DOS 2.0 or later.
In Short: Based on an entity set structure, this programmable network DBMS offers a powerful programming language for the serious applications designer. PC-based files can be moved among a variety of operating environments, and a comprehensive interactive tutorial helps to explain the program's nontraditional approach. Copy protected.

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COMPANION PRODUCTS Designed primarily for the serious programmer, *Zim*'s command-driven interface can be simplified through the companion product, Zim/DA. Zim/DA comprises an application generator, menu generator, data dictionary, report painter, code editors, and context-sensitive help.

Zanthe Information offers many other companion products for *Zim* besides Zim/DA. The Programming Language Interface lets you access *Zim* databases through the C programming language. Zim-ISQL, expected to be released in May, allows you to query *Zim* databases using SQL constructs. And Zimple is an add-on that allows end users to build simple applications, make ad hoc queries, and paint their own reports.

One option offered with the package, the Zim Security module, provides security at the database and field level and also for directories, entity sets, and relationships within the program. Without this option, *Zim* will still allow you to create password forms that check for user name, number, and/or password.

Contained in *Zim*'s original package are several utilities that perform such tasks as checking the integrity of a particular entity set or relationship file, recovering information from damaged files, creating or recreating indexes for existing files, and enlarging a database file.

Before all this, however, is an easy installation process. Simply create a directory on your hard disk and copy an INSTALL.BAT file from one of the seven *Zim* floppy disks. Next you execute the INSTALL.BAT from your hard disk and follow subsequent screen prompts that indicate when to switch floppy disks. Although *Zim* is copy protected, requiring a keydisk in a floppy disk drive even when running the program from a hard disk, an extra $50 buys you an unprotected system.

DOCUMENTATION The Zim interactive tutorial contains enough information to make you comfortable with the concept of the entity set and whets your appetite by introducing you to some of the package's more-advanced features. In addition, *Zim*'s six manuals and guidebook, all clear and concise, will go a long way toward helping you gain expertise. Clearly laid out and focusing on a specific topic, each manual has an index that includes cross-references to other manuals. Finding where you want to go and the fastest way to get there is easily accomplished.

If you need to develop major applications that will be run on various operating systems, *Zim* is definitely worth your consideration. While its programming language and entity set structure take time to master, the rewards in terms of application speed and versatility may be well worth it.

—Michael L. Brown and Edward L. Perratore PC

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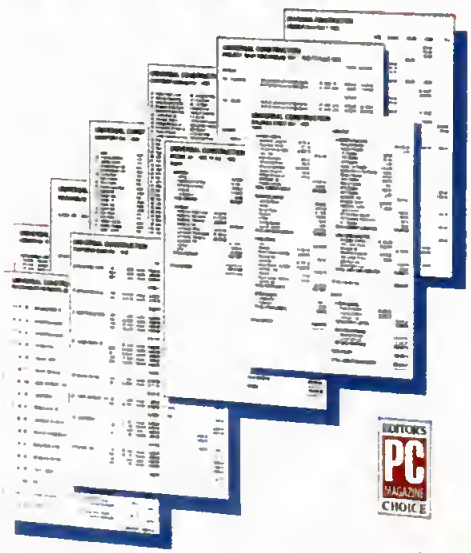
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SQL: AN EMERGING DATABASE STANDARD FOR PCs

■

Want to make the most of dissimilar databases and computers? Then tap into Structured Query Language (SQL), a powerful database language that may hold the key to portability. Reviewed here are five SQL-based packages from Informix, Oracle, Relational Technology, Software Systems Technology, and Unify.

It's been 6 years since IBM released SQL/DS, the first commercial relational database product for mainframes running under DOS/VSE and VM/CMS. Since then, the mainframe, minicomputer, and microcomputer marketplaces have been flooded with DBMSs that claim to be relational. But for the most part, PC-based database products, like their mainframe and minicomputer counterparts, do not fully conform to the relational model that was set forth by Dr. Edgar Codd, a mathematician and IBM Fellow, nearly 2 decades ago.

In an influential paper entitled "A Relational Model of Data for Large Shared Data Banks," published in the *Communications of the ACM* in June 1970, Codd established the principles for a database management system that became known as the relational model. Underlying the relational model is the idea that mathematics can be used to fortify the principles of database management. The entire field of relational database technology is founded on this work.

IN THE BEGINNING It was Codd who formulated the concept of the data model, which is used to describe the different ways in which data is organized and manipulated in a database management system. While implementations of both hierarchical and network database systems existed prior to 1970, the models behind these systems were not formally defined until much later, by abstracting from existing products. Relational database systems, by contrast, did not appear until after the relational model had been defined.

Codd's work led to a great deal of research and experimentation, including the development of prototypes of a number of relational languages that concretize some or all of the features of the relational model. One of these was a language called

CODD'S RELATIONAL MODEL, PART 2: HAS ANYBODY GOT IT RIGHT YET?

As we discussed in the previous issue, the inventor of the relational approach to databases, Dr. Edgar F. Codd, has not been entirely happy with how the world has treated his invention.

Formerly an IBM scientist, now a consultant in industry and a seminar leader as president of the Relational Institute and chief scientist of Codd and Date International, Codd changed forever the way software developers look at databases. By offering the mathematically based idea of linking several datafiles through "relations," or common fields, and seeing all data as existing in two-dimensional tables, Codd introduced a superior conceptual approach to managing large volumes of data.

Unfortunately, no matter how elegant and precise the relational algebra of Codd's model, users can tap its power only through commercial products. And Codd is absolutely right when he says that no currently available programs fully embody the ideas of his relational model.

CODD'S APPRAISAL "In the personal computer world, take two extremes," Codd says, "one faithful, one not at all faithful but popular. Nucleus has very good technology, and I have high hopes for it. It comes closer to the relational model than anything else I've seen. *dBASE* became popular by claiming it was relational, but it wasn't.

"*Oracle* on the PC, for example," he says, "is much more relational than *dBASE*—though I have to say: *Oracle* claims compatibility with IBM's relational products, but that's not true. There are still some incompatibilities.

"The biggest disappointment in *Oracle* is that in the Connect command, *Oracle* created a command that produces a nonrelational result. It produces tables that rely on "nextness"—which a relational database never would—and you can't use succeeding relational commands on that table!

"My whole goal with the relational model was to produce a single, simple interface available to all users, programmers or not. Users don't need to get into iterative loops, recursive programming, the other little tricks programmers love.

"IBM's own database products still don't fit the relational model. And they don't address referential integrity at all.

"I tried in writing my 12 rules for testing whether a database program fits the relational model to provide a simple basis for comparisons. But when we compared IBM's *DB2*, Cullinet's *IDMS/R*, and ADR's *Datacom/DB*, IBM got 7 of a possible 12—while the others got zero.

"My rules are adequate to make that kind of sharp distinction, but there are subtleties at work, too, which they overlook. In fact, the rules and that 7-of-12 make *DB2* look better than it really is. There's a lack of updatability; it doesn't support domains, primary keys . . . elementary things, but IBM doesn't support them."

THE UPDATED MODEL Codd senses times have changed since his first statement and restatement of the relational model. His partner, Chris Date, has become well known for his books explaining database theory and relational technology in particular, but Codd is now readying his own new book.

"I'm going to call it *The Relational Model, Version 2*," Codd says, "because things *have* changed, the model has changed." Due from Addison-Wesley late this year, Codd's book may offer a new impetus for software developers to track his relational model more closely.

As one of the very few people who have envisioned a fundamentally different way of approaching the manipulation of data, he will no doubt continue to provoke vendors with barbed remarks when their products fall short of his expectations, and to challenge their programmers with his precise and elegant vision of relationality.—**Jim Seymour**

Structured English Query Language, or SEQUEL, which was defined by D.D. Chamberlin and others at IBM's Research Laboratory in San Jose, California, in 1974. A version called SEQUEL/2 was defined in 1976 and later called SQL.

These developments led researchers at IBM's San Jose Research Laboratory to create a relational database prototype called *System R*. *System R* sported a large subset of SEQUEL/2 and became operational in 1977. Its success convinced IBM to develop a number of relational products with SQL implementations. In 1982, IBM announced SQL/DS; the following year, it introduced DB2 for mainframes running under MVS, and this still remains the best known product among DBMSs for large systems. At about the same time, other vendors began to construct their own SQL-based products. Codd's additional refinements to the relational model resulted in "Twelve Rules for Deciding How Relational a DBMS Product Is" (see sidebar).

In 1986, the American National Standards Institute (ANSI) ratified SQL as a standard relational database language. With the imprimatur of ANSI and the support of IBM, SQL has become the de facto standard query language for relational DBMSs.

THE RELATIONAL MODEL Probably the most important development in the history of database technology, the relational model describes a way of looking at data and prescribes how data is to be represented and manipulated. Its great value lies in the fact that it interposes a layer of abstraction between the external view of a database (that is, the way it's perceived by users and applications) and the way data is

THE TWELVE COMMANDMENTS

E. F. Codd has posited twelve rules for determining how relational a DBMS product is.

Rule 1: All information in a relational database is represented explicitly at the logical level and in exactly one way—by values in R-tables.

Rule 2: Each and every datum (atomic value) in a relational database is guaranteed to be logically accessible by resorting to a combination of R-table name, primary key value, and column name.

Rule 3: Indicators (distinct from the empty character string or a string of blank characters, and distinct from zero or any other number) are supported in fully relational DBMS for representing at the logical level the fact that *the information is missing* (applicable and inapplicable information) in a systematic way—independent of data type. Besides the logical representation, the DBMS must support manipulative functions for these indicators and these must also be independent of the data type of the missing information.

Rule 4: The database description is represented at the logical level just like ordinary data, so that authorized users can apply the same relational language to its interrogation as they apply to the regular data.

Rule 5: A relational DBMS (no matter how many languages and what modes of terminal use it supports—for example, the fill-in-the-blanks mode) *must* support at least one language (1) whose statements are expressible per some well-defined syntax as character strings; and (2) which is *comprehensive* in supporting *all* of the following items:

1. data definition
2. view definition
3. data manipulation (interactive and by program)
4. integrity constraints
5. authorization
6. transaction boundaries (begin, commit, and rollback)

Rule 6: The DBMS includes an algorithm at least as powerful as VU-1 for determining (at view definition time) whether that view is tuple-insertible and tuple-deletable, and whether each of its columns is updatable. It records the result of this investigation in the catalog.

Rule 7: The capability of handling a base relation or a derived relation as a single operand applies not only to the retrieval of data but also to the insertion, update, and deletion of data.

Rule 8: Application programs and terminal activities remain logically unimpaired whenever any changes are made in either storage representations or access methods.

Rule 9: Application programs and terminal activities remain logically unimpaired when information-preserving changes of any kind that theoretically permit unimpairment are made to the base tables.

Rule 10: Integrity constraints specific to a particular relational database must be definable in the relational data sublanguage and storable in the catalog (not in the application programs).

Rule 11: A relational DBMS has distribution independence.

Rule 12: If a relational system has a low-level (single-record-at-a-time) language, that low level cannot be used to subvert or bypass the integrity rules and constraints expressed in the higher-level relational language (multiple-records-at-a-time).

Copyright © 1986 E. F. Codd/The Relational Institute. All rights reserved. This material will be included in a book by E.F. Codd to be published soon by Addison-Wesley. To obtain Dr. Codd's technical reports, contact the Relational Institute, 6489 Camden Ave., #106, San Jose, CA 95120.

managed internally.

While users of nonrelational systems are required to manipulate data structures that are closely linked to the underlying storage system, users of relational systems are not. In the relational model, a database is viewed simply as a collection of tables, each composed of one or more columns and zero or more rows. The means by which tables are stored and retrieved are hidden from the user. Although links or pointers may exist at the physical level, the relational model makes no restrictions on how the physical storage system operates.

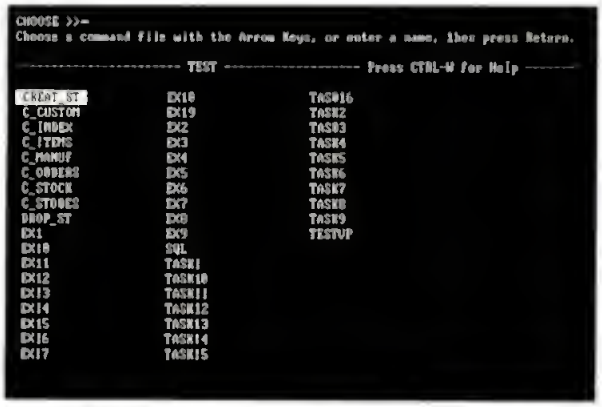
Additionally, the relational model specifies that the operators available for data retrieval generate new tables from older ones. Relational operators may extract a subset of rows or columns from a table. Since these subsets may also be considered tables, the model is consistent.

The relational model demands a high degree of data independence: the database should not be affected if changes are made to the storage structure and access strategy. Nor should applications or users depend on any one storage structure or access strategy being used by the system.

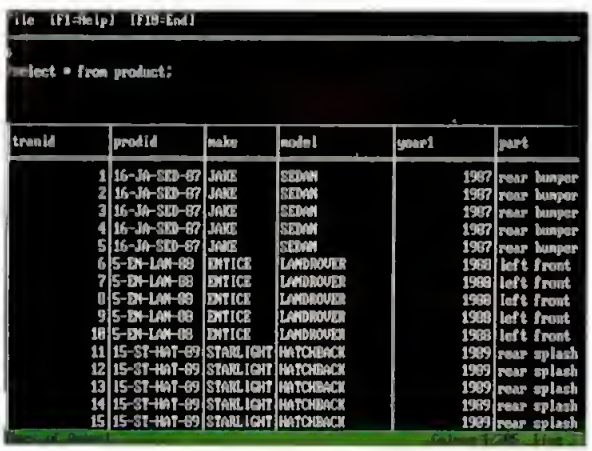
Indeed, in a true relational system, applications are not even aware of what access strategy is being used. Instead, the system will attempt to find the best path to the data being requested by an application. Thus, the application is not required to know how to access the requested data; it concentrates instead on what data is being requested.

RELATIONAL ALGEBRA Codd and his associate Christopher J. Date have specified a set of fundamental operations to be used in the relational model. These are the

SQL ON-SCREEN



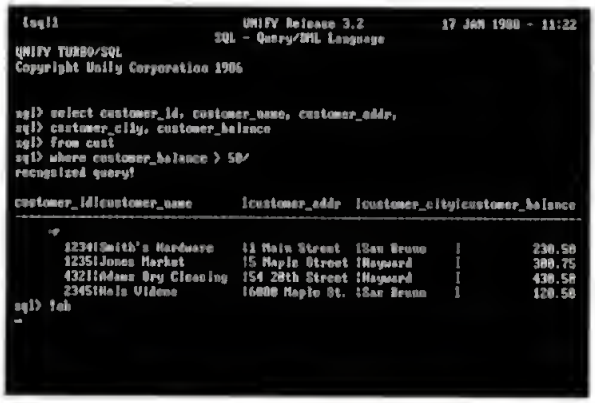
Although **Informix-SQL** *allows you to select stored commands by highlighting the desired file, this capability does not extend to the selection of SQL commands themselves. Once the command set (or report or form) is selected, it can be either displayed on-screen, modified, or executed.*



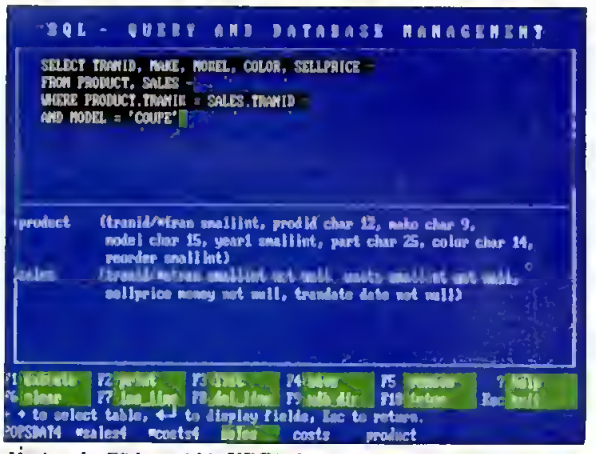
This is a display of ISQL query results using **Ingres for PCs.** *The first page of data appears almost immediately; you then have the option of running the query to completion. In a select of the PC Labs 50,000-record table, for example, the first page of data appeared in less than 5 seconds, even though the entire query took nearly 26 minutes to complete.*



Level 3 in **Professional Oracle***'s form-building process allows for use of a default item. The Choose Block window's options include creating or modifying the individual units that comprise a form.*



The SQL provided by **Unify RDBMS** *allows you to perform such procedures as multiple table joins, sum and count, nested queries, groups, and sorts.*



Hitting the F9 key within **XDB***'s Interactive SQL editor will display the names of existing database tables at the bottom of the screen. Windows display field definitions of each table selected.*

basis for what is formally known as relational algebra (there is also a notational derivative called relational calculus).

Drawn from mathematical set theory, these operations always result in a new table being derived from one or more other tables. Here is a list describing their use in a relational DBMS in terms of rows, columns, and tables:

- **Selection** retrieves a specified set of rows from a table.
- **Projection** retrieves a specified set of columns from a table.
- **Product** retrieves all of the possible combinations of one row from each of two tables.
- **Union** retrieves all of the rows appearing in either or both of two tables.
- **Intersect** retrieves only those rows that appear in both of two specified tables.
- **Difference** retrieves all rows that appear in the first but not in the second of two tables.
- **Join** retrieves all possible pairs of rows (one from each of two tables) that jointly satisfy some specified condition.
- **Divide** retrieves a set of rows built from two tables—one table having one column (known as unary) and the other with two columns (binary). If a value in the unary table matches a value in a specified column of binary table, the parallel value in the *other* binary column becomes a row in the "divide" set.

AN INTRODUCTION TO SQL SQL was developed as a means of expressing these operations on relational databases in a high-level form. While SQL is still used today as an interactive query language, a number of implementations allow it to be embedded in PL/1, COBOL, and C. And with the introduction of Ashton-Tate's *dBASE IV* (scheduled for release in July), which will have full relational capabilities and a robust implementation of SQL, users will be able to embed SQL statements in *dBASE* application code.

Strictly a database language, SQL has no inherent program control statements or operators, such as If-Then or While. This is why it is combined with other high-level languages when used for database manipulation in an application program.

This "deficiency" is SQL's greatest strength: while SQL doesn't know about program control, it eliminates the need for an applications development language to know anything about the structure or nature of the database being manipulated. Thus, SQL provides a high-level view of a relational database that is consistent with the relational model.

SQL includes a data definition language (DDL), a data manipulation language (DML), and data control facilities for controlling database access privileges.

The DDL is used to create and define the database tables as well as the names and types of the columns of a table. For instance, the code

```
(partid          CHAR(10)  NOT NULL,
 make            CHAR(10),
 model           CHAR(10),
 part            CHAR(20),
 UNIQUE(partid))
```

would create a database table for storing automobile parts, with a Part-ID column that must have a unique value (specified by Not Null and Unique). The DDL can also be used to create and define indexes on a table and virtual tables or views.

The DML is probably the most powerful aspect of SQL, since DML statements operate on entire sets of rows, not just one row at a time. This is something that most high-level programming languages are unable to do.

As an example, let's compare queries in SQL and *dBASE III*, a database language at a much higher level than PL/1 or C. Suppose you had two tables, the parts table described above and a related table containing sales figures for those parts. If you wanted to retrieve selected columns from each, for sales in 1988 in sales-date order, you would have to execute the following commands in *dBASE III*:

```
select b
use parts index partid
select e
use sales index saladata
set relation to salesid into b
find "880101" do while date>="880101";
.and. date<="881231" .end.
.not. eof()
? b->part,b->make,b->model,;
date,price,units
skip
enddo
```

In this example, *dBASE* presupposes the definition and creation of the partid and saledate indexes. Without them, the query will fail. Either you will have to take the time to create these indexes or you will have to use another approach. In addition, if the output is to be used for any other operation, it will have to be massaged at this stage: there is no facility for manipulating the result as a set.

Now here is the equivalent command set in SQL:

```
SELECT      parts.part, parts.make,
            parts.model,
            sales.date,
            sales.price, sales.units
FROM        parts, sales
WHERE       parts.partid = sales.salesid
            and sales.date
            between "880101" and "881231"
ORDER BY    sales.date;
```

There are three ways in which this query can be utilized. First, it can stand as is, and the result will appear on the terminal screen. Second, the result can instead be represented by a pointer known as an SQL Cursor. Cursors are used to point to the result of a query, allowing each row of the result to be processed individually by the user or an application program. Third, the entire Select can be used in a DDL statement to define a virtual table that consists of the specified columns and the resulting rows (so the result can be treated as a table in itself).

In this example, SQL does not specify the use of an index in the DML statements. Instead, the system will determine the optimal method for retrieving the data, and what indexes (if any) are present that might be used. Thus, row ordering is executed

OUR REVIEWERS

Marc M. Groz, formerly a research analyst with Morgan Stanley & Co., is an independent consultant specializing in the design of financial and related systems.

Vincent Puglia, a free-lance consultant, is a frequent contributor to *PC Magazine*.

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Programmable SQL-based Database Managers: Summary of Features

(Products listed in ascending price order)

	PC XDB-SQL $495	Informix-SQL $795	Unify RDBMS $795	PC Ingres for PCs $950	PC Professional Oracle $1,295
Program type	Relational	Relational	Relational	Relational	Relational
PROGRAM SIZE					
Installed program size (kilobytes)	1,900	1,700	4,600	6,000	6,000
Min. no. of program files	3	16	2	18	2
FILE STRUCTURE LIMITS					
Field size	1,500 characters	Unlimited	256 bytes	2,008 bytes	240 characters
Fields per record	400	Unlimited	256	127	255
Fields per database	Unlimited	Unlimited	1,900	Unlimited	Unlimited
Record size (bytes)	32,767	32,767	25,600	2,000	Unlimited
Records per data file	4 billion	Unlimited	Unlimited	Unlimited	Unlimited
Data files per database	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Records per database	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
DATA FIELDS					
Max. size of character fields (characters)	1,500	Unlimited	256	255	240
Max. size of long text fields (characters)	1,500	N/A	N/A	2,000	65,535
Max. size of numeric fields (digits)	4	32	9	4	40
Max. size of currency fields (characters)	13	32	11	8	N/A
Max. size of date fields (characters)	8	20	8	12	Unlimited
Max. size of time fields (characters)	6	N/A	5	12	N/A
Max. size of Boolean fields (characters)	N/A	N/A	N/A	N/A	240
Other fields	None	Serial, decimal	Combined, floating-point	None	None
DATA FIELD ATTRIBUTES					
Tests for valid data ranges	Automatic	User-defined	Automatic	Automatic	User-defined
Provides default values	●	●	●	●	●
Checks for specific values	User-defined	User-defined	User-defined	Automatic	Automatic
Verifies data via a lookup table	●	●	●	●	●
Provides automatic data entry from lookup table	User-defined	User-defined	Automatic	Automatic	User-defined
Double-entry verification	N/A	User-defined	N/A	Automatic	Automatic
Requires all fields to be filled	Automatic	User-defined	N/A	Automatic	Automatic
Offers "forced uppercase" option	N/A	User-defined	N/A	Automatic	Automatic
Converts date formats	N/A	User-defined	N/A	Automatic	User-defined
Increments fields	N/A	User-defined	User-defined	Automatic	N/A
Unique fields	User-defined	User-defined	Automatic	Automatic	Automatic
Fixed values for data entry fields	User-defined	User-defined	User-defined	Automatic	User-defined
Calculated fields on entry screen	●	●	○	●	●
Carryover from previous record	User-defined	Automatic	N/A	Automatic	Automatic
Error handling	Automatic	User-defined	Automatic	Automatic	Automatic
Data dictionary/catalog	Automatic	Automatic	User-defined	Automatic	Automatic
User-accessible data dictionary	Automatic	Automatic	User-defined	Automatic	Automatic

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable; program does not have this feature.

	XDB-SDL	Informix-SDL	Unify RDBMS	Ingres for PCs	Professional Oracle
DATA IMPORT EXPORT	$495	$795	$795	$950	$1,295
DIF	●/●	○/○	○/○	○/●	○/●
DBF	●/●	○/○	○/○	●/●	○/○
PFS	○/○	○/○	○/○	○/○	○/○
SDF	○/○	○/○	○/○	●/●	●/○
SYLK	●/●	○/○	○/○	○/●	○/○
WKS	○/○	○/○	○/○	○/●	○/○
ASCII	●/●	●/●	●/●	●/●	●/●
DB2 or SQL/DS	●/●	○/○	○/●	○/○	○/○
User-defined	●/●	○/○	●/●	●/●	○/●
Specific minicomputer format	○/○	○/○	○/○	●/●	○/○
Specific mainframe format	○/○	○/○	○/○	●/●	○/○
DATA MANIPULATION					
Max. no. of indexing fields	400	Unlimited	8	Unlimited	Unlimited
Max. no. of compound indexes	10	8	8	20	255
Unique index value	○	○	●	●	○
Respecify indexed fields	●	●	●	●	●
Automatic index maintenance	●	●	●	●	●
Respecify file definition	●	●	●	○	●
Multiple record deletions	●	●	●	●	●
Multiple record updates	●	●	●	●	●
Math updates	●	●	●	●	●
Text updates	●	●	●	●	●
Max. no. of view tables	Unlimited	Unlimited	N/A	10	Unlimited
Max. no. of join tables	10	2	Unlimited	10	15
Max. no. of project tables	Unlimited	1	Unlimited	10	Unlimited
Max. no. of union tables	20	32	N/A	10	Unlimited
Max. no. of intersect tables	Unlimited	2	N/A	N/A	Unlimited
Max. no. of append tables	1	1	Unlimited	10	Unlimited
Max. no. of open data files	250	32	1	10	Unlimited
SORTING					
Permanent	○	○	○	●	○
Temporary (for duration of command)	●	●	●	●	●
Sorts on any field	●	●	●	●	●
Sorts on indexed field only	○	○	○	○	○
Max. no. of fields sorted at once	64	8	256	9	15
SEARCH PARAMETERS					
First occurrence	●	○	●	○	●
All occurrences	●	●	●	●	●
Index field only	○	●	○	○	●
Max. no. of multiple fields	Unlimited	Unlimited	256	Unlimited	Unlimited
Case-sensitive	●	○	●	●	●
Whole word	●	○	●	●	●
Value or character range	●	●	●	●	●
Wildcard or string segment	●	●	●	●	●
Boolean	●	●	●	●	●
Compound Booleans	○	○	○	●	●

(continues)

Programmable SQL-based Database Managers: Summary of Features

(Products listed in ascending price order)

	XDB-SQL	Informix-SQL	Unify RDBMS	Ingres for PCs	Professional Oracle
QUERY FACILITIES	$495	$795	$795	$950	$1,295
Query language	●	●	●	●	●
Proprietary	○	○	○	○	○
dBASE III–compatible	○	○	○	○	○
ANSI SQL–compatible	●	●	●	●	●
DB2 SQL–compatible	●	○	○	●	●
Query by example	○	○	○	●	●
Query by forms	●	●	●	●	●
Multiple file access	●	●	●	●	●
Query editor support	●	●	●	●	●
Stored queries	●	●	●	●	●
MATHEMATICAL FUNCTIONS					
Date arithmetic	●	●	●	●	●
Time arithmetic	●	●	●	●	●
Arithmetic functions	●	●	●	●	●
Exponential functions	●	○	○	●	●
Trigonometric functions	●	○	○	●	●
Financial functions	●	●	○	○	●
Aggregate functions					
Totals	●	●	●	●	●
Subtotals	●	○	●	●	●
Average	●	●	●	●	●
Count	●	●	●	●	●
Maximum	●	●	●	●	●
Minimum	●	●	●	●	●
STATISTICS					
Standard deviation	○	○	○	○	●
Variance	○	○	○	○	●
COMMAND STRATEGY					
Static menus	●	●	○	●	●
Dynamic menus	●	●	●	○	●
Typed commands	●	●	●	●	●
Supports mouse	○	○	○	○	●
MACROS					
Automatic recording	○	○	○	●	○
Keystroke macro	○	○	○	●	●
Macro language	○	○	○	●	○
INPUT FACILITIES					
Max. no. of screens per file	4	Unlimited	11	Unlimited	Unlimited
Max. no. of files per screen	Unlimited	Unlimited	1	10	Unlimited
Screen definition					
Painting	●	○	●	●	●
Coordinates specification	●	●	○	○	○
Automatic field-name replacement	●	●	●	●	●

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable program does not have this feature

	XDB-SQL	Informix-SQL	Unify RDBMS	Ingres for PCs	Professional Oracle
OUTPUT FACILITIES	$495	$795	$795	$950	$1,295
Multiple-file reports	●	●	●	●	●
Page breaks	●	●	●	●	●
Breaks when fields change	●	●	●	●	●
Report definition method					
Painting	○	○	○	○	○
Forms duplication	●	○	○	○	●
Automatic	●	●	○	●	○
Predefined mailing labels	○	○	○	○	○
Programmable	●	●	●	●	●
Stored report definitions	●	●	●	●	●
Line-based	●	●	●	●	●
Form-based	●	●	○	●	●
Output destination					
Printer	●	●	●	●	●
Screen	●	●	●	●	●
Disk	●	●	●	●	●
DOS SUPPORT					
Change default directory	●	○	○	○	●
Access from another directory	●	●	○	●	●
SECURITY					
Passwords for databases	●	○	●	●	●
Passwords for files	●	○	○	●	○
SPECIAL FEATURES					
Applications generator	○	●	○	●	●
Menu generator	●	●	●	●	○
USER SUPPORT					
Cost of telephone support	Free	15% of software cost (unlimited support for 1 year)	90 days free, then: $750 premium support with upgrades; $500 write-in support, $300 for 12 hours support in 1 year	$2,000 (unlimited calls)	$500/year
Automatic on-line help	●	●	●	●	●
Tutorial	●	●	●	●	●
Prompt messages	●	●	●	●	●

1,364 36

PC MAGAZINE Benchmark Tests: SQL-based Database Managers

Structured Query Language (SQL) packages are the relative newcomers among database programs. The results of the PC Labs benchmark tests show they are no better than the fastest among the other programmables and no worse than the slowest. Their strength, instead, lies in the terseness of the command structure and in the purported compatibility of SQL code among all SQL-based packages, whether on microcomputer, minicomputer, or mainframe; this means that SQL applications are portable.

Among the packages we tested, *Unify RDBMS* exceeded the 3-hour time limit for importing the 50,000-record file, but that result was nonetheless included because the package performed satisfactorily in several of the other 50,000-record tests. And the PC Labs tests uncovered a sleeper in *XDB-SQL*, which took first or second place in six out of seven tests. No optimizations were attempted with any of the SQL databases except where specifically mentioned in the accompanying reviews.

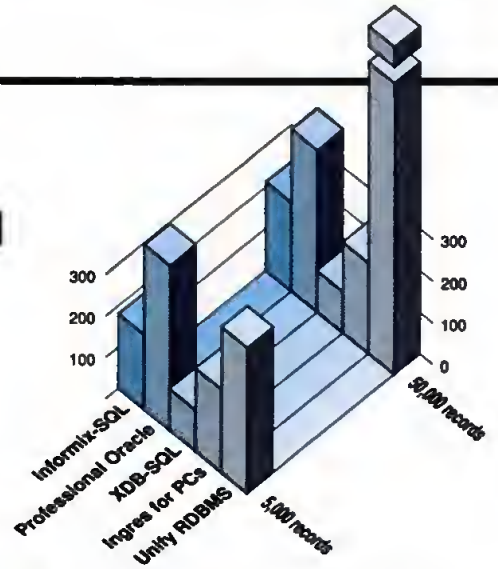
PC Labs supplied the reviewers of SQL-based programs with ANSI-compatible SQL code for performing all of the tasks except reporting. The intention was to see whether SQL products that were touted as being compatible with IBM DB2 or ANSI SQL could use a set of generic SQL code to complete the suite of tests.

Reviewers were asked to use three of the four SQL data manipulation language (DML) commands—Select, Update, and Insert—and such data definition language (DDL) commands as Create Table and Alter Table.

On the whole, the DML commands varied little among the five programs. Where the implementations differed was in their use of delimiters and symbols. As a result, in some cases the reviewers made character substitutions, such as a single quotation mark for a double quotation mark or the "%" wildcard symbol for the "*" symbol.

The DDL implementations, by contrast, varied greatly. Although the reviewers had to make minor alterations to some commands, such as changing "char" to "vchar" to designate the same data type, they had to modify others—such as the Alter Table command—more extensively.

IMPORT



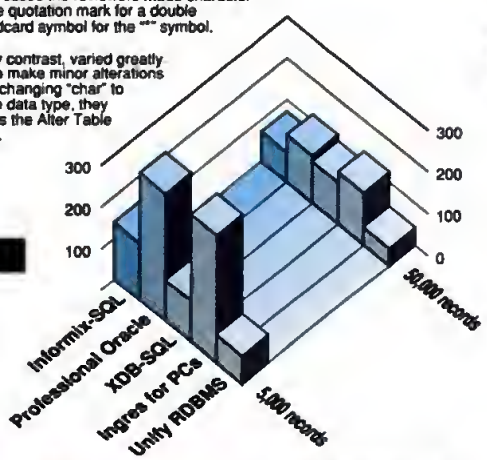
Relative Times
(*XDB-SQL* = 100)

Performance Times
(Times given in seconds)

	5,000 records	50,000 records
Informix-SQL	213.90	2,475.55
Professional Oracle	468.14	4,505.46
XDB-SQL	118.00	1,156.00
Ingres for PCs	235.37	2,522.56
Unify RDBMS	413.00	15,772.00

The **Import** test measures how quickly the database can import an ASCII file (of either fixed field length or comma-delimited format) with an index on the first field. We included the indexing portion of the test to avoid penalizing programs that automatically index the first field during the data conversion. Some programs required a two-step process for this test: an import followed by indexing.

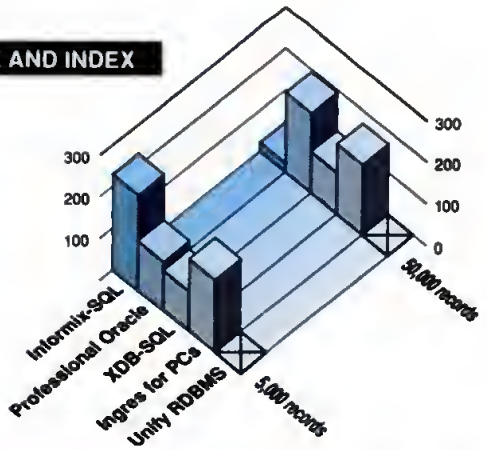
SEARCH



	5,000 records	50,000 records
Informix-SQL	12.58	10.15
Professional Oracle	27.67	16.09
XDB-SQL	9.00	14.00
Ingres for PCs	27.77	17.54
Unify RDBMS	6.00	6.00

The **Search** test measures the time it takes to locate the first record that satisfies two criteria (make = Fendhi and model = coupe).

DELETE AND INDEX



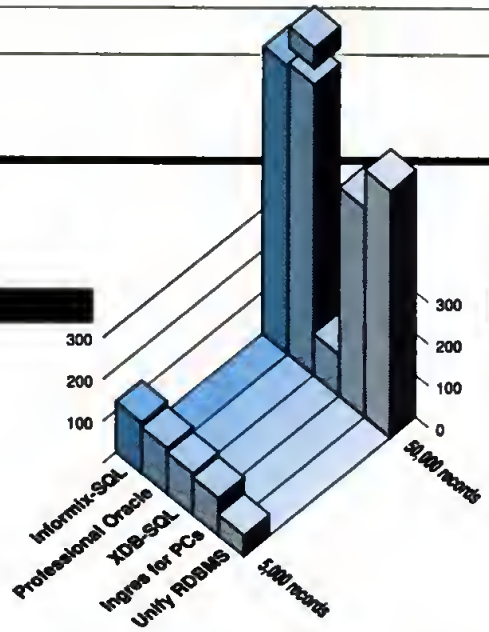
	5,000 records	50,000 records
Informix-SQL	258.82	319.55
Professional Oracle	135.47	2,775.01
XDB-SQL	113.00	1,433.00
Ingres for PCs	200.68	2,419.13
Unify RDBMS	NAD	NAD

NAD = Could not accomplish task as defined.

The **Delete and Index** (four-column version) test measures the time required to remove four columns (Units, SellPrice, BuyPrice, and TranDate) from a Product table created for this task, and then to reindex the file, if necessary.

1,720.30

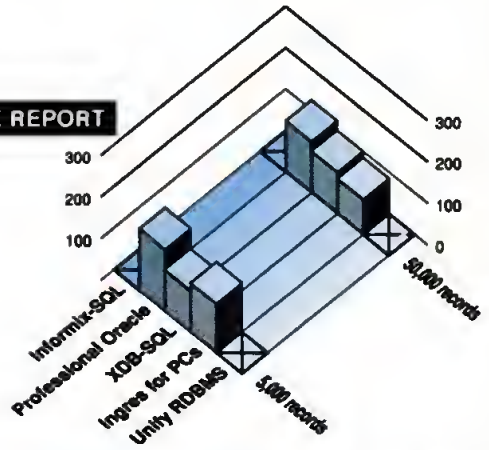
SORT



	5,000 records	50,000 records
Informix-SQL	222.78	3,590.38
Professional Oracle	202.25	8,945.55
XDB-SQL	183.00	520.00
Ingres for PCs	165.58	2,621.60
Unify RDBMS	93.00	3,090.00

The **Sort** test measures the time it takes for the package to sort the files on an unindexed field in ascending order.

THREE-TABLE REPORT

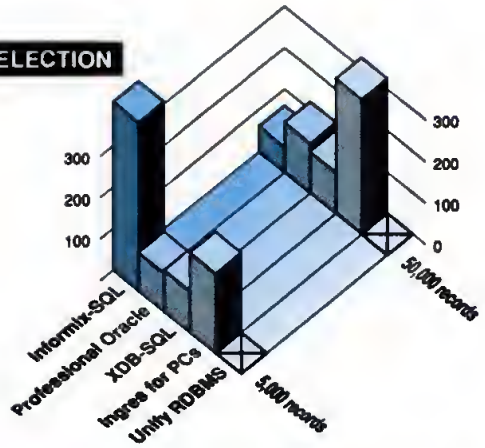


	5,000 records	50,000 records
Informix-SQL	NAD	NAD
Professional Oracle	446.93	5,377.00
XDB-SQL	300.00	4,358.00
Ingres for PCs	355.20	3,694.05
Unify RDBMS	NAD	NAD

NAD = Could not accomplish task as defined.

The **Three-Table Report** test generates a report for those records whose "year" field is equal to 1988 or 1989. The report is made up of 16 fields and is sorted (in ascending and descending order) on 3 of those fields. The test calculates two subtotals and the difference between them at one breakpoint, a subtotal at the second breakpoint, and a grand total at the end of the report. The resulting file is sent to a RAMdisk.

DISTINCT SELECTION

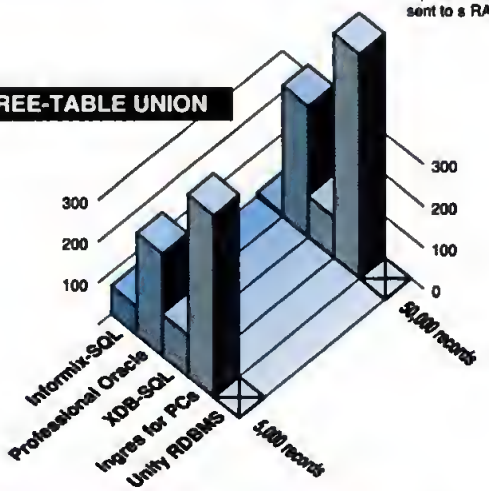


	5,000 records	50,000 records
Informix-SQL	154.18	275.65
Professional Oracle	34.92	543.47
XDB-SQL	38.00	455.00
Ingres for PCs	72.90	1,481.75
Unify RDBMS	NAD	NAD

NAD = Could not accomplish task as defined.

The **Distinct Selection** test measures the time it takes to produce a sorted listing of unique values for a given column (Part_ID).

THREE-TABLE UNION



	5,000 records	50,000 records
Informix-SQL	15.64	15.67
Professional Oracle	56.58	601.78
XDB-SQL	23.00	190.00
Ingres for PCs	100.90	1,031.52
Unify RDBMS	FNA	FNA

FNA = Feature not available.

The **Three-Table Union** test measures the time it takes to select the Tran_No for those rows that satisfy three different criteria (Part_ID like "NC", Buy > $25.00, and Units < 50).

Name Brands. Discount Prices.

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- 80286-12 Dual Speed Processor
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Complete System Price	**$1299**
System without monitor	1199
System with Samsung CGA color monitor	1499
System with NEC Multisync II EGA monitor	1999
System without hard disk drive	899
Base System	499

XT DRIVE KITS

			HIT	BARE
Seagate	DMP-ST225	20MB, 65ms, ½ ht, 5.25", w/WD controller	$259	$217
Miniscribe	DMP-5425	20MB, 85ms, ½ ht, 5.25", w/WD controller	$267	$211
Miniscribe	DMP-5425+	20MB, 53ms, ½ ht, 5.25", w/WD controller	$298	$257
Seagate	DMP-ST238	30MB, 65ms, ½ ht, 5.25", w/Adaptec cont.	$298	$257
Seagate	DMP-ST238	30MB, 65ms, ½ ht, 5.25", w/WD controller	$298	$257
Miniscribe	DMP-5438	30MB, 65ms, ½ ht, 5.25", w/Adaptec cont.	$279	$243
Miniscribe	DMP-5438	30MB, 85ms, ½ ht, 5.25", w/WD controller	$279	$243
Miniscribe	DMP-8438	30MB, 65ms, ½ ht, 3.5", w/Adaptec cont.	$329	$296
Miniscribe	DMP-8438	30MB, 65ms, ½ ht, 3.5", w/WD controller	$329	$296
Seagate	DMP-4096	30MB, 40ms, full ht, 5.25", w/WD controller	$548	$495
Miniscribe	DMP-3650	40MB, 65ms, ½ ht, 5.25", w/WD controller	$389	$352
Seagate	DMP-ST251	40MB, 40ms, ½ ht, 5.25", w/WD controller	$429	$393
Micropolis	DMP-1335	70MB, 28ms, full ht, 5.25", w/WD controller	$799	$762
Miniscribe	DMP-6085	70MB, 28ms, full ht, 5.25", w/WD controller	$829	$792
Seagate	DMP-4096	80MB, 28ms, full ht, 5.25", w/WD controller	$944	$891

*XT kits include drive, controller, bezel, 20/34 pin cable, mounting hardware and manual

UNINTERRUPTIBLE POWER SUPPLIES

TRIPPLITE	PP-TRP-BC200	200 watt battery back-up	$286
American Power	PP-APC-SH300XT	300 watt battery back-up	$299
American Power	PP-APC-SH450AT	300 watt battery back-up	$427
TRIPPLITE	PP-TRP-BC325	325 watt battery back-up	$341
TRIPPLITE	PP-TRP-BC450	450 watt battery back-up	$478
American Power	PP-APC-SH600XT	600 watt battery back-up	$715
TRIPPLITE	PP-TRP-BC675	675 watt battery back-up	$593
TRIPPLITE	PP-TRP-BC750	750 watt battery back-up	$806
TRIPPLITE	PP-TRP-BC1000	1000 watt battery back-up	$868
American Power	PP-APC-SH1200VX	1000 watt battery back-up	$947
TRIPPLITE	PP-TRP-BC2000	2000 watt battery back-up	$1307

VIDEO BOARDS

Genoa	DM-GEN-4050-1	EGA board	$174
Genoa	DM-GEN-4050-5	EGA/CGA/MDA/HERC comp, 640x480 res.	$219
Video Seven	DM-VID-VEGA-DL	VGA/EGA/CGA/MDA/HERC comp, 640x480 res.	$247
Genoa	DM-GEN-4050-8	EGA/CGA/MDA/HERC comp, 800x600 res.	$269
NEC	DM-NEC-GD1	EGA/CGA/MDA/HERC comp, 640x480 res.	$285
Video Seven	DM-VID-VEGA-VG	VGA/EGA/CGA/MDA/HERC Comp. 800x600 res.	$299
Genoa	DM-GEN-4050-7	VGA/EGA/CGA/MDA/HERC comp, 800x600 res.	$299
Photon Mega	DM-PCG-1000+	1024x768 res, for NECXL/Plus	$899
Photon Mega	DM-PCG-102A+	1024X768 res, analog fro NECXL	$1199

TAPE BACK-UP KITS

Irwin	TP-IRW-120XT	20MB, int, ½ ht, w/tape for XT	$249
Irwin	TP-IRW-125AT	20MB, int, ½ ht, w/tape for AT	$249
Irwin	TP-IRW-145S	40MB, int, ½ ht, w/tape for XT	$287
Irwin	TP-IRW-145AT	40MB, int, ½ ht, w/tape for AT	$299
Mountain	TP-MNT-5740-01	40MB, int, ½ ht, w/tape for XT/AT	$237
Mountain	TP-MNT-5740-01	40MB, int, ½ ht, w/tape for PS2AT	$291
Mountain	TP-MNT-5720-01	40MB, ext, ½ ht, w/tape for PS2 AT	$287
Mountain	TP-MNT-5779-01	40MB, ext, ½ ht, w/tape for AT/XT	$299
Archive	TP-ARC-MIT-XT	60MB, int, ½ ht, w/tape for XT/AT	$299
Archive	TP-ARC-2057SMS	60MB, ext, ½ ht, w/tape for AT	$299
Archive	TP-ARC-MIT-XT	60MB, int, ½ ht, w/tape for XT	$299

HARD DISK CONTROLLERS

Western Digital	DC-WES-WD-WX2	ST506, MFM comp. for XT	$ 59
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Western Digital	DC-WES-1002-WX1	ST506, MFM comp. for XT	$ 69
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independently of the existence of an index.

The key to SQL is the difference between *haw* and *what*: specifically, how to retrieve data versus what data to retrieve. Instead of specifying the "how" like other database and high-level languages, SQL specifies the "what,"—and the relational DBMS does the rest. The user (or an application program) does not manually navigate the physical database, since this is performed automatically by the system.

IBM OR ANSI? ANSI SQL is essentially a subset of the SQL dialect found in IBM's DB2. Most implementations distinctly follow one or the other (*dBASE IV*, for example, will use an SQL implementation derived from DB2's SQL), but a number of subtle differences distinguish IBM SQL from ANSI SQL.

In DB2, all operators are available in all contexts where they make sense, so both DDL and DML operations can be run interactively or from within a program. Also, DB2 supports DDL commands for dropping (deleting) or modifying the definition of tables, views, and indexes apart from Create Table. There are Create commands for views and indexes. Finally, DB2 includes a catalog, a set of system tables that contains the database definition or schema. Under DB2, a catalog can be interrogated via ordinary Selects.

ANSI SQL, however, limits the use of data definition operations in a program, requiring them to be mostly interactive. There are no Alter commands in ANSI SQL, nor is the concept of a system catalog part of the standard.

THE CURRENT CROP The five SQL-based DBMSs reviewed in this issue—*Informix-SQL*, *Ingres for PCs*, *Professional Oracle*, *Unify RDBMS*, and *XDB-SQL*—all claim the title "relational." But closer inspection reveals some chinks in their armor.

Some of these packages support a superset of ANSI SQL; in some cases, the vendors have attempted a full implementation of the SQL in IBM's DB2. Of the five, *Ingres* and *Oracle* appear to have adhered the closest to the relational model, with *XDB* not far behind. These have implemented a superset of DB2, with *Oracle* strong on manipulating distributed databases. *XDB* has extended SQL with additional functions and commands not found in either the ANSI or DB2 definitions.

All of the packages support interactive SQL. Some, like *XDB*, allow you to embed SQL in C, Pascal, and COBOL, while others, such as *Unify*, provide no interface for embedded SQL.

View support seems to be the order of the day. With the exception of *Unify*, all of the packages provide for view creation and updates. In fact, *Unify* is the oddball of the group. Its interpretive SQL is strictly a DML: you must define databases elsewhere. It claims a speed advantage by providing built-in links between tables, but these dilute data independence. And it violates Codd's Non-Subversion rule, since the C interface can be used to go around the relational interface. This is also true of the beta version of *dBASE IV*.

Both *Unify* and *Informix* make it tempting to use their B-tree and ISAM products, encouraging data dependence. *Informix*

PC MAGAZINE EDITOR'S CHOICE

- Ingres for PCs
- Professional Oracle
- XDB-SQL

The least expensive of the five packages reviewed here, Software Systems Technology's XDB-SQL *($495), caupled with* XDB-Forms *($295), is the relational DBMS that PC users with little knowledge af SQL will find easiest to use. SQL novices will be helped along by* XDB-SQL*'s menu-driven user interface and help screens, which make the program the mast user-friendly of thase we evaluated. But ease af use isn't all this package offers. In additian ta its compatibility with IBM's DB2 and ANSI SQL,* XDB-SQL *has all the tools yau'll need ta develop sophisticated applications, including a farms generator, a report writer, a menu generatar, and a procedural language.*

Of the SQL-based relational DBMSs that have migrated to PCs fram mainframes and minicamputers, twa stand aut. Relatianal Technalagy's Ingres for PCs *($950) is but ane member in a product line that runs the gamut from IBM mainframes to DEC minicomputers ta UNIX-based machines. In addition ta offering a host af well-integrated application development tools and two query languages,* Ingres for PCs *has a menu-driven user interface that bespeaks the care its developers took in rewriting the package for PCs. The program's ties to multiuser systems through* Ingres/Net *and to distributed databases through* Ingres/Star *make the package a powerful tool far pratatyping as well as networking.*

Oracle Carp.'s Professional Oracle *($1,295, or $195 for developers) shows its roots in large systems more than* Ingres for PCs *does, but that is ane af this product's strengths.* Professional Oracle *brings ta the PC almost all of the capabilities that are present in the mainframe version of this package, including file locking and deadlock detection. A primarily command-driven package,* Professional Oracle *gives great sway ta database administratars wha are cancerned both with optimizing their system's performance and with maximizing data security. Its full adherence to 8 af Codd's 12 rules far relatianal databases and partial canfarmance to the remaining 4, its compatibility with both IBM's and ANSI's SQL implementatians, and numerous tools and utilities make* Professional Oracle *an excellent choice for experienced applications develapers.*

even supports a column called RowID in every table, so that applications and users can reference rows by number. This is a surprising feature in a relational product.

Although these violations run counter to Codd's relational model, they shouldn't prevent you from considering any of these products as your database of choice. None will fully adhere to the relational model, but those with an implementation of IBM's SQL and a system catalog that can be queried using SQL fulfill 7 of 12 rules: enough to be called relational, according to Codd, and enough to be called practical, according to most users. Read on to find out what our experts think of this powerful and diverse group of packages.

Richard Hale Shaw is a software engineer for Hilgraeve Inc., a Monroe, Michigan–based vendor of communications software, and is a frequent contributor to PC Magazine.

Informix-SQL

Among the major players in the SQL-based DBMS arena for PCs, *Informix-SQL* ($795) from Informix Software may have the fewest bells and whistles, but what it does have is certainly worthy of serious consideration by SQL aficionados.

Informix-SQL consists of three main modules: ISQL, the Informix version of SQL; Perform, the built-in forms generator; and Ace, the built-in report generator—all of which are accessible through a *1-2-3*–like menu bar that is displayed at the top of the screen. Upon entering any of the modules, you can select such options as command files, databases, tables, or columns from a selection list that sits just below the 1-*2-3*–style menu, or you can type in your selection on the command line. Before you can create any operations, however, you need to know *Informix*'s procedural RDBMS language, SQL keywords, and syntax fairly well.

SQL commands are executed from *Informix*'s built-in query editor. If you've entered the incorrect syntax for a command, *Informix* halts execution and displays an error message, and the cursor highlights the Modify option. If you choose to modify the command, the cursor reappears in the edit screen, either directly after the offending phrase or at the end of the command. But if you fail to set CONFIG.SYS for files=50, *Informix* cannot find its message files and all error messages are displayed as numbers.

Informix's built-in query editor is limited in scope, allowing you to insert and delete characters, delete text from the cursor to the end of a line, and redisplay the screen. These operations are accomplished with Ctrl-key sequences. The built-in editor does not support block operations, nor does it accommodate commands of over 80 characters per line, or a group of com-

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mands that take up more than one screen, or command sets larger than 1K. You can get around these limitations by entering your commands in the text editor of your choice or in the default text editor, which is DOS's EDLIN.

FORMS AND REPORTS Both Perform and Ace are relatively easy to use and maintain—if your needs are simple. The easiest way to create a form or report is by accepting *Informix*'s defaults, which will list the columns for the designated table from top to bottom. To make slight modifications to a form or report, you will have to alter only one or two lines of code. If you want to design a more complicated form or report, however, you will have to alter the default SQL code so that it instructs *Informix* to select multiple tables and include user verifications, variables, column and line positions, or video attributes.

Informix creates a separate directory for each database and names each directory with a .DBS extension. Even before you enter data, the program creates a minimum of five system-related tables and nine index files, all of which are used to maintain the database. For transaction-file databases, *Informix* creates additional log files. From all of these files, you can retrieve database statistics. You can also retrieve data about the structure and state of your database—including table, column, and index names and sizes—by selecting options from many of *Informix*'s submenus.

Like Relational Technology's *Ingres for PCs, Informix* treats the quotes surrounding text within comma-delimited files as part of the text value. When you need to import an ASCII file, you can change the delimiter *Informix* uses with the DOS SET command, but the program will only allow you to use one character as a delimiter. You can, of course, mask the quotations by creating dummy columns. But if you've embedded commas within the text of your ASCII files and also used them as delimiters, you will find that a misplaced comma will wreak havoc on your import. Once you have successfully imported your files, though, you'll be able to manipulate them in countless ways with *Informix*'s ISQL.

HELP—UP TO A POINT If you are not well schooled in data definition language coding, don't worry. *Informix* provides a module that will build the database for you one step at a time. Acceptable data types include character, date, money, and numeric (decimal, small integer, integer, small float, float, and serial). The serial data type allows you to assign sequenced integers to columnar data. *Informix* also allows for multiple-column indexes and unique indexes in ascending or descending order.



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***Informix-SQL*, Version 2.0**
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List Price: $795
Requires: 640K RAM, hard disk, DOS 2.1 or later.
In Short: Although *Informix*'s SQL implementation is full-featured, its forms and reports generators are limited in scope and functionality. As a result, users will need to do more coding—in both SQL and RDBMS (*Informix*'s procedural language)—than they would with other SQL-based packages. Not copy protected.

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Informix's manual is divided into three sections: user guide, reference, and appendix. The user guide includes a well-written, well-paced tutorial. Although novices will find *Informix*'s documentation helpful, they may not have such a positive experience with the package's on-line help, which is essentially a repetition of SQL syntax and error messages. Users who hate to look in an appendix for explanations of error messages will also feel frustrated: error messages abound and many of them are not documented.

Informix yielded respectable results in the PC Labs benchmark tests, and with its robust version of SQL, it has shown itself to be a capable applications builder—if you don't mind bearing with the limitations of Ace, Perform, and the built-in text editor. Sandwiched between Software Systems Technology's *XDB* and Microrim's *R:base for DOS* at the low end and Relational Technology's *Ingres* and Oracle Corp.'s *Oracle* at the high end, *Informix-SQL* has some stiff competition in the race to win users who just can't wait for IBM's long-anticipated PC-based DBMS.—**Vincent Puglia**

Ingres for PCs

Organizations that need a programmable DBMS and the power of SQL would do well to consider *Ingres for PCs*, a $950 package from Relational Technology that features good performance and an abundance of tools for developing custom database applications. Among these tools are two query languages, a menu-driven interface, a query-by-forms facility, a visual-forms editor, a report writer, a fourth-generation language, a preprocessor for embedding database calls in C language programs, a visual-query language, and a gateway to *dBASE* files.

The *Ingres* Local Data Management Package contains 12 distribution disks, an Installation Guide, a tutorial manual, and a Reference Guide. Installing the distribution disks onto your hard disk is a breeze. After installing the software, the first thing you should use is *Ingres* Tutor, an interactive tour of *Ingres for PCs*. When you are ready to go beyond the Tutor, work your way through *Getting Started in Ingres*, the well-written tutorial that introduces novices to relational concepts and describes the package's features. As informative as this tutorial is, and as well adapted to PC architecture as the whole product is, don't be fooled: *Ingres* databases and custom applications are best built by users with experience in database design. After that, *Ingres*, which has a menu-driven user interface, can easily be used by all levels of users.

EDITOR'S CHOICE

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***Ingres for PCs*, Version 5.0**
Relational Technology Inc.
1080 Marina Village Pkwy.
Alameda, CA 94501
(800) 4-INGRES
(415) 769-1400
List Price: $950
Requires: 640K RAM, hard disk, DOS 2.1 or later.
In Short: Featuring good performance and an abundance of tools for creating customized database applications, *Ingres* has the most user-friendly interface of the major SQL-based RDBMSs brought to the PC from the mainframe and minicomputer environments. The package doesn't support null values and does not offer the Alter Table command. Not copy protected.

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Unless a custom application has been built, the menu-driven interface is the first thing you will see after invoking *Ingres*. It gives you access to all of the other parts of the program and contains its own easy-to-use method of examining existing tables, creating new ones, and generating simple reports. You can create all of your database tables from this menu-driven interface, which means that you do not need to know SQL to build a database. The menus look and act like *1-2-3* ring menus, which should make them easy for PC users to navigate.

CHOICE OF LANGUAGES *Ingres* contains two relational query languages: SQL and QUEL, which can generally be used to accomplish the same tasks. Although some users consider QUEL to be somewhat easier to use, it has not gained the widespread industry support that SQL has, which is why SQL is a better choice for developing database applications.

The Interactive SQL interface (ISQL) allows you to enter and run queries in a simple full-screen editing environment. These queries can be written to DOS disk files and retrieved later to be run again. One of *Ingres*'s strong points is that SQL is also used in the fourth-generation language, the preprocessor for C, and the report writer, allowing you to apply your knowledge of SQL to using all of *Ingres*'s tools.

All SQL-based DBMSs differ somewhat from the ANSI standard, and *Ingres*, which is based on both ANSI and IBM SQL implementations, is no exception. *Ingres* does not support null values and does not contain the Alter Table command. This means that you will need to store missing values as blank for character fields and zero for numeric fields, and that if you want to add a column to a table, you will need to create a new table containing both the old columns and the new column, then copy the data into the new table. *Ingres* does offer multiple types of indexing and storage structures for tables (B-tree, ISAM, hash, and heap), which is a big plus because it gives you more flexibility in structuring your database than any of the other SQL products do. This flexibility will allow you to fine-tune a database for maximum performance.

Another strong point is *Ingres*'s visual-forms editor (VIFRED), a screen-painting tool that lets you create data entry forms. You can generate default forms for one or more tables, which is handy for entering data into tables with a master/detail relationship. The forms are used in the query-by-forms facility to enter, retrieve, or update data in tables. In fact, you can use query-by-forms instead of ISQL for most simple database queries, which means that you do not have to learn SQL to query an *Ingres* database. Your imagination is the limit when it comes to designing forms, since *Ingres* lets you specify default values, lookups in other tables, video attributes, and much more.

REPORT GENERATION There are two methods of reporting information in *Ingres*. You can use *Ingres*'s menu-driven interface to generate simple or ad hoc reports, but to produce more-complex and customized reports you must use the Report Writer, which has its own powerful command language. In Report Writer, you use an SQL statement to retrieve the data to be reported and a series of dot commands to format the output. The dot commands require some effort to learn, and this is one topic for which the Reference Guide needs more examples. There is a minor error in some of the Reference Guide's examples: you need to use double quotes rather than single quotes around literal string values.

Along with the Report Writer, applications developers will find *Ingres*'s Applications-By-Forms (ABF), a nonprocedural development environment for creating forms-based applications, to be an important tool. You can access database tables using SQL and manipulate the screen in any imaginable way using forms. ABF can also be used by nonprogrammers for an easy way to assemble custom menus for running query-by-forms and reports. If you need to produce custom user interfaces to your database, this is the tool to use.

For writing custom applications in a programming language, Ingres/ESQL (Embedded SQL) lets you use a procedural language, Microsoft C, to access database tables by embedding SQL statements into C programs. Because it includes all of the SQL commands found in ISQL, ESQL gives you the full power of SQL plus record-at-a-time capability. Well suited for writing batch processing applications, ESQL can also be used for creating forms-based applications with calls to the *Ingres* Forms Run-Time System.

MAKING CONNECTIONS *Ingres for PCs* is one member of a line of *Ingres* products that runs on IBM mainframes, DEC minis, UNIX computers of all sizes, and others. Using the networking capabilities, you can transparently access data on any other computer running *Ingres*. Once the connection is established, you can manipulate tables as if they were on your own computer. You can also develop database applications on the PC and move them to larger computers without having to change them. This makes *Ingres for PCs* a wonderful tool for prototyping.

■ With its powerful SQL implementation, *Ingres* has made a successful transition from the mainframe world to the PC environment.

Ingres's Visual Query Language is likewise useful for querying remote databases. It assists you with a query-by-example approach that makes retrieving data simple. It can also transfer data into files that can be used with *Lotus 1-2-3*. *Ingres*'s *dBASE* Gateway option—an important feature for users with existing *dBASE* databases— can read and write *dBASE* files, letting you join data stored in *dBASE* files with data in *Ingres* tables without having to do an import or export.

Ingres for PCs performed well in the PC Labs benchmark tests. All of the tests except the report were completed with ISQL, which was a pleasure to use. Beyond building a B-tree primary key on the database tables, we did not attempt to optimize the performance of *Ingres* or the test database, although the package does allow you to increase the number of data buffers to boost performance on large tables. You can also change the storage structure on tables with static data to ISAM or hash to increase query speed.

With its powerful SQL implementation, excellent networking capabilities, menu-driven interface, and comprehensive tools for building complex databases and custom applications, *Ingres* has made a successful transition from the mainframe and minicomputer worlds to the PC environment. If you're concerned with portability of applications across hardware platforms but don't want to sacrifice ease of use to get it, *Ingres for PCs* may be just the mature, reliable product you're looking for.—**Steve Roti**

Professional Oracle

A great philosopher once said of the Delphic oracle that it neither reveals nor conceals, but only gives indications. The same can be said of *Professional Oracle*, a modern relational DBMS that, in the hands of sophisticated users, is a product with near-prophetic capabilities, but whose complexities may tax novices.

Priced at $1,295 ($195 for developers, with licensing restrictions), *Professional Oracle*, Version 5.1, is a powerful, flexi-

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***Professional Oracle*, Version 5.1**
Oracle Corp.
20 Davis Dr.
Belmont, CA 94002
(800) ORACLE1
(415) 598-8000
List Price: $1,295; developer's price, $195 (with licensing restrictions).
Requires: 1.5MB RAM, hard disk, DOS 3.1 or later.
In Short: A powerful and flexible SQL-based DBMS, *Oracle*'s strengths are its security and performance optimization capabilities, a full complement of development tools, and consistency across environments. Its roots in the mainframe and minicomputer worlds are reflected in its user interface. Not copy protected.

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ble package with many of the capabilities of its minicomputer and mainframe counterparts. True to those origins, *Professional Oracle* provides sophisticated database management capabilities for security and performance optimization.

Offering compatibility with IBM's SQL/DB2 as well as ANSI SQL, *Oracle* surrounds these standards with many useful features, ranging from command-driven SQL*PLUS (an interpreted extension of SQL) to SQL*FORMS (a menu-driven interface for the design of applications based on data entry screens). Additional utilities allow for importing and exporting of data, spreadsheet functions, and interfacing with high-level procedural languages. Because of its size and power, *Professional Oracle* requires 1MB of extended memory, as well as an 80286 or 80386 processor.

Professional Oracle does not skimp on documentation. Three slipcover boxes open to reveal 24 volumes weighing in at more than 20 pounds. At first, this seems overwhelming, but the documentation is quite well organized and readable. The installation and user guide is the only system-specific manual in the collection, eloquent testimony to *Oracle*'s consistency across environments.

Installation is relatively straightforward. *Professional Oracle* comes with 18 disks, comprising (in order of installation) ORAINST, the RDBMS, the Oracle utilities, SQL*PLUS, SQL*FORMS, SQL*CALC, SQL*REPORT, and PRO*C. You can install all the disks at one time in about an hour, or you can install only those tools you need, adding others later. Oracle Corp. suggests that you install at least the disks up to and including SQL*FORMS.

FULL FEATURES Having installed *Professional Oracle*, you have at your disposal a standalone relational DBMS with almost all the features of its mainframe and minicomputer counterparts (such as file locking and deadlock detection) implemented. Unlike *Ingres*, for example, *Professional Oracle* supports transaction processing, security, and space allocation and provides partial integrity. Thus, a developer can write a multiuser system on *Professional Oracle* that will behave properly when transferred to a multiuser environment.

Professional Oracle conforms fully to 8 of the 12 rules for relational databases laid down by IBM Fellow Edgar Codd, and it conforms in part to the other 4. Here it compares favorably with other relational DBMSs. The PC version of *Ingres*, for example, fully satisfies only six of Codd's rules and partially satisfies three others. *Ingres* lacks support for null values, updating of views, and integrity independence. Built-in functions like AVG (average) can be embedded in subqueries in *Oracle*, but not in *Ingres*. The trade-off between *Oracle* and *Ingres* is clear: *Oracle* wins on power and portability; *Ingres* is simpler and has more full-screen interfaces.

■ *Professional Oracle* does not skimp on documentation. Three slipcover boxes open to reveal 24 volumes weighing in at more than 20 pounds.

A default database is created when *Oracle* is installed. This consists of two files, DBS.ORA and DBS2.ORA, which together take up about 2MB. Associated with the database is a before-image file, BI.ORA, which *Oracle* uses as storage space for changes that have not yet been made permanent. Big applications require that the database be enlarged and special space definitions made.

Professional Oracle lets you act as your own database administrator, granting various degrees of access to different user IDs and auditing the use of database objects. Default security features prompt for user ID and password, and no auditing is done unless requested.

You can manage the use of space in the database through the CCF (Create Contiguous File) utility. The SQL commands Create, Drop, and Alter, acting upon spaces, clusters, and partitions, provide further versatility in defining and controlling disk space. Once again, defaults are provided.

You can also use data clustering and space allocation to optimize performance. For example, if some data items are often queried together, clustering can put that data close together on the disk. In addition, you can improve performance by modifying queries to take best advantage of physical parameters and logically equivalent SQL statements.

UTILITIES AND TOOLS *Professional Oracle* comes with several utilities for moving data in and out of the *Oracle* database. You must use ODL (Oracle Data Loader) when bringing external data into the database for the first time. Export and Import are related utilities. Export is used for compacting database objects (or entire databases) and for sending them to other environments. Import is used for rebuilding databases that have been fully or partially exported. Both Import and Export are interactive, with helpful prompts. Translation between EBCDIC and ASCII is performed automatically if required.

ODL works with variable-length ASCII files, but only the last field in the file can be a variable-length field. You must create a control file to provide ODL with information about the file being brought in and the table into which the data is being loaded. Note that the table must already have been created in SQL*PLUS. If any indexes are to be created, it is more efficient to do so after ODL has loaded records into the table. ODL, which executes from DOS, creates a log file that provides statistics on the load. Rejected records are deposited in a separate file for possible reloading.

In addition to SQL*PLUS and SQL*FORMS, *Professional Oracle* comes with a diversity of tools. SQL*PLUS is a good place to begin to get a feel for *Oracle:* an easy-to-use interpreted language whose primary purpose is the creation and manipulation of tables and views within a database. It provides the basic interface for SQL, extended to allow report formatting, data type conversion, and access control. You can use either a



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simple line editor or your favorite text editor to edit and save SQL command files. Within SQL*PLUS, you can also execute DOS commands and generate most reports.

SYSTEMS AND APPLICATIONS Using SQL*PLUS is also a good way to learn SQL. You can use either SQL*PLUS or SQL*FORMS to develop prototype systems and to create simple reports. The difference is that in SQL*PLUS you work directly with SQL commands and *Oracle*'s SQL extensions, whereas in SQL*FORMS you work primarily on forms, blocks, and pages.

■ Well constructed and powerful, *Professional Oracle* is an excellent choice for experienced application developers.

For applications development, turn to SQL*FORMS and the other tools. SQL*FORMS is composed of four modules: IAD (Interactive Application Designer), IAC (Interactive Application Converter), IAG (Interactive Application Generator), and IAP (Interactive Application Processor). IAD is used to create forms; IAC converts them to a standard format for use on other machines; IAG reconverts them for use on a specific system; and IAP runs the form. In other versions of *Oracle* a menu is provided for selecting among these modules, but because of DOS memory limitations, they must be called individually from DOS in *Professional Oracle*.

SQL*FORMS approximates a fourth-generation language, allowing you to design an application nonprocedurally by creating forms from defaults or from scratch. Forms are composed of blocks that are related to one or more database tables, and contain fields whose attributes can be checked for data type, various default values (table lookup), maximum and minimum values, uniqueness of records, and so on. Forms can call other forms, and the end user can move from screen to screen as a result of single or multiple actions or conditions. Forms also can be made to operate on the databases by means of triggers, which can be thought of as nonprocedural programs (actually, they are sets of special commands that are executed when the user performs an action, or when some event takes place).

SQL*CALC is a spreadsheet program that can be used to analyze and update the database. SQL statements can be entered into cells of the spreadsheet. With the next release of *Professional Oracle*, you will be able to load *Lotus 1-2-3* .WK1 and .WKS files into an *Oracle* database using SQL*LOADER. A direct interface, *Oracle for 1-2-3* ($199), has also been announced.

SQL*REPORT is a report writer that allows for the creation of very complex reports. As in ODL, you must create a control file by using an external text editor. PRO*C is a precompiler with which you can embed SQL statements into Microsoft and Lattice C programs.

In the benchmark tests *Professional Oracle* performed well, compared with other SQL-based relational DBMSs. Well documented, well constructed, and powerful, *Professional Oracle* is an excellent choice for experienced application developers, especially those who want a product that is consistent across environments. For serious users of data, consulting this oracle is very rewarding.—**Marc M. Groz**

Unify RDBMS

For years, *Unify RDBMS* has been among the leading database software programs in the UNIX world. Its excellent programmer interface and development tools have made it a favorite of application developers. Experienced *Unify* users will be pleased to find the $795 DOS version nearly identical to the UNIX version.

In fact, that may be *Unify*'s biggest stumbling block to attracting new DOS users—it's too much like its UNIX cousin. Because *Unify* does not abide by the standards DOS users have come to expect of their software, it's likely to frustrate DOS users. For instance, DOS users expect to

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be able to enter database commands in either upper- or lowercase. But all *Unify* commands must be entered in lowercase—uppercase will cause an error. Other commands, such as having to type Ctrl-U instead of pressing the Esc key to exit a function, are just as frustrating. And, *Unify* cannot import *Lotus 1-2-3*, *dBASE*, SDF, or .DIF files. In fact, the only file type it can import is an ASCII delimited format that cannot have quotes around the text fields—which is not very common in the DOS world.

The first thing you notice about *Unify* when you open the package is that the vendor provides the program disks in a nice plastic holder. When you open it up, you realize why such a nicety is needed: *Unify* takes up a whopping 15 program disks. Installing the program is quite simple, though, with the most difficult part being the "fatigue factor" of inserting and extracting 15 disks.

Unify's documentation consists of three well-written binders—including a reference manual, a programmer's manual, and a tutorial manual. The experienced user will rely on the reference manual for information on specific topics, while those interested in developing custom applications in C will find the programmer's manual quite helpful. The tutorial is a great way for new users to learn *Unify* concepts and commands quickly.

MENU METHODS The *Unify* menus offer several methods of selecting options that accommodate all users' levels of familiarity with the program. You can use the arrow keys to highlight your desired choice and then type F1 to select it, or you can simply enter the number of the selection you desire. Or you can enter the program name of the option you desire, and *Unify* will take you to that function immediately. As you become familiar with the program names (displayed in the upper-left corner of each screen) you will find yourself using this method instead of going through two or three menus to get to the function you desire.

■ *Unify* takes up a whopping 15 disks. Installing the program is quite simple, though; the most difficult part is the "fatigue factor" of inserting 15 disks.

Among the field types you can select in *Unify* are string, numeric, amount, float, date, and time. One field in each table must be identified as the primary key field; data entered into the table will be automatically indexed on this field. To speed retrievals in large databases, you can create a B-tree index on any field or group of fields in the database. You can add and drop B-tree indexes at any time through a simple menu-driven function.

With *Unify*'s Paint Screen Forms menu option, you can create data entry forms. Using the *Unify* screen editor, you just enter the form text where you want it. To define the location of a database field, you simply go to the desired position, type A to display the field name entry window, and enter the field name. For fancier screens, you can specify video attributes such as reverse video and underlining. *Unify* forms will allow you to include fields from more

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***Unify RDBMS*, Version 3.2**
Unify Corp.
3870 Rosin Ct.
Sacramento, CA 95834
(916) 920-5553 (information hotline)
(916) 920-9092

List Price: $795
Requires: 640K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: Brought over from the UNIX environment, *Unify* offers SQL, screen painters, and an excellent interface to the C programming language. Beware of *Unify*'s non-DOS-like interface and inability to import and export standard DOS-format files. Not copy protected.

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than one table; however, the additional fields will be for display only. If you require a data entry screen that includes modifiable fields from multiple tables, you must create a custom C program. *Unify*'s Advanced Field Attributes function allows you to define ranges, default values, and messages for each field in a table.

Searching for data can be performed in two ways. The simpler way is to use the Query by Forms function. Query by Forms displays a blank data entry form, and you simply enter the values to search for in the appropriate fields. Records found on your search can be displayed on-screen or sent to a report format file for printing.

SUPERB SQL The second method of searching is to use *Unify*'s Structured Query Language (SQL). For searching and manipulating data, *Unify*'s SQL is superb. You can perform multiple table joins, aggregate functions (such as sum and count), nested queries, groups, and sorts. Using the data manipulation functions, you can append data from a table or from an ASCII file to an existing table. The update and delete commands will modify or delete data throughout your table. Conspicuously missing from *Unify*'s SQL implementation are union and project commands, as well as the capability to create and drop tables and indexes.

The *Unify* report writer offers the flexibility to produce a wide variety of reports, from simple columnar listings to complex data tables. This flexibility is provided by a nonprocedural language consisting of a series of powerful report format commands. Within the report format command files, you can define report headers, footers, control breaks, and variable fields. The data for the report can come from an SQL or Query by Forms query, a custom-designed user program, or an ASCII file.

The benefit of this approach is twofold. First, because database manipulation is handled prior to the formatting and printing of the report, the creation of the report format command file is less complex. Second, the report format command file may not have to be changed even if the data passed to it has.

For those uncommon functions you can't perform within *Unify* itself, a Host Language Interface allows you to create custom C programs. The interface includes an abundance of database functions that can be embedded into your C programs. Although this is clearly not for everyone, experienced C programmers will find it simple to create applications that include these functions.

LIFESAVING LOGGING *Unify* provides several tools to assist you in maintaining and administering the database. One excellent tool that can be a lifesaver is transaction logging. *Unify* will record all transactions you perform since your last backup. If a hardware or software failure occurs and your database becomes corrupted, you can restore your last backup and replay the recorded transactions to bring your database to its proper current state.

Unify has a complete set of data dictionary and database statistical reports to assist the user in maintaining and documenting the system. However, all references to disk space usage are in blocks, not bytes—an example of *Unify*'s UNIX roots.

You'll want to take a closer look at *Unify* if you're looking for a database that offers many sophisticated database functions, SQL, and an excellent interface to C. At the same time, *Unify*'s reluctance to incorporate standard DOS conventions—as witness its inability to import and export traditional DOS formats—limits this product.—**T. J. White**

XDB-SQL

In the two years since its introduction, *XDB-SQL* by Software Systems Technology has gained a strong reputation in the SQL-oriented database marketplace. *XDB* boasts SQL compatibility with *DB2*, IBM's mainframe relational database, and compliance with the proposed ANSI standard. Beyond its rich SQL implementation, *XDB* provides the user with the tools to create sophisticated database applications—including a forms generator, a report writer, a menu generator, and a procedural programming language. But don't let this sophistication frighten you: *XDB* assists the new user by providing a menu-driven user interface, help screens, and thorough documentation.

Software Systems Technology offers several XDB Database System products. The principal product is *XDB-SQL*, which costs $495 and has all of the basic database functionality offered in the *XDB* line. However, *XDB-SQL* alone is weak for users who want to create even moderately complex data entry screens. *XDB-Forms* is an optional module, priced at $295, that overcomes this weakness; in fact, it's an exceptional tool for both the novice and the experienced user. Other packages include *XDB-Graph* ($69), a business graphics tool; *XDB-Learn* ($39), a full-function tutorial; and *XDB-C*, *XDB-COBOL*, and *XDB-Pascal* ($395 each), which provide programming interfaces to *XDB* databases.

The installation of the six program disks is quite simple. An install program copies all of the *XDB* program files to your hard disk. Although *XDB* requires modification to your CONFIG.SYS and AUTOEXEC.BAT files, the courteous install program will append its required additions to your files instead of creating new versions and renaming (or worse, erasing) your existing files.

The *XDB* main menu displays the ten primary options available. As with all *XDB* menus, to make a selection you sim-

EDITOR'S CHOICE

PC MAGAZINE FACT FILE



***XDB-SQL*, Version 2.1**
Software Systems Technology Inc.
7309 Baltimore Ave., #219
College Park, MD 20740
(301) 779-5486
List Price: $495; *XDB-Forms*, $295.
Requires: 512K RAM (640K RAM recommended), two floppy disks (hard disk recommended), DOS 2.1 or later.
In Short: *XDB*'s primary strengths are its fine implementation of SQL and its menu-driven user interface. Also includes an easy-to-use report writer, a menu generator, and both a procedural language and—for more serious software developers—interfaces to standard programming languages. A must-see for those interested in SQL. Not copy protected.

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ply type the appropriate function key or the first letter of the choice desired. The bottom three lines of each *XDB* screen furnish a short help message or instruction to guide you through the current process. For additional assistance, you can press a help key at nearly any point to display a full page of context-sensitive help text.

FIELDS AND FORMS You can create database tables by using the Create Table command within the SQL editor, or through a table creation screen similar to that of *R:base System V*. Field types include small integer, large integer, float, decimal, money, date, time, character, and variable character. The variable character field, which provides for up to 1,500 characters input, will save to disk only the length of the field that contains data. Fixed-length fields save to disk the entire length of the field—regardless of the amount of data contained in it. The variable character method, therefore, can save you a significant amount of disk space if you have a large database with character fields that vary substantially in length.

The Forms Manager, used to create the image of a paper form on the screen, can be used for either data entry or for printing forms. Paint the form on the screen using the editor provided. For each data entry field on the screen, *XDB* will prompt you for the input parameters, such as the field type, default value, minimum and maximum values, and a list of allowable entries. You can create calculated fields that will perform a calculation on other fields within the form. For more-complex forms, *XDB* provides the capability to update up to ten tables within one form.

The Forms Manager lookup feature allows you to retrieve data from another table based on the information in a given field. For instance, by entering a part number on an order entry screen, you can have the Forms Manager look up and display the part name from a parts table. The lookup function also provides a browse feature that can alleviate a lot of frustration for data entry people. In the above example, you could press the PgUp or PgDn key at the part number field, scrolling through the valid part numbers while displaying their part names until the desired part name is found.

FULL-FUNCTION SQL Make no mistake, SQL is the heart of this database. Whether you create a table, a data entry screen, a report, or a custom program, you will use SQL. *XDB*'s full-function SQL gives you nearly all the functionality found in mainframe systems. You can create tables and views, perform relational operations such as joins and unions, create simple and nested queries, and arrange query results using the Group By, Having, and Order By clauses.

From the interactive SQL screen, the user can enter and execute SQL commands. Unfortunately, the editor provided by *XDB* contains limited word-processing functionality. But the editor's ability to display field names and lengths from any table in your database on a split screen is very helpful. SQL statements can be saved for later recall.

The results of SQL statements are displayed on a second screen. From this screen you can create a report (or a graph, if you've purchased the optional module) or print the results to a file or printer.

REPORTS *XDB* takes a unique approach to creating reports: the formatting is done on-screen with live data. The beauty of this approach is that you see your format changes immediately. No longer will you face the laborious effort of changing the format, saving your format file, and then running the report to see the effect of your changes, as is common in other database packages.

To create a report, you first execute an SQL command to display the data you want in the report. Function-key options then permit you to perform such functions as totaling and averaging columns; adding, deleting, and moving columns; creating subtotals; creating column format masks; creating report and column headings; and many others. You will be surprised at the number of options available. After you are satisfied with the format of your report, you can save the format file for later use. (The report format file is an ASCII file that contains each of the format options you selected.)

Although the report writer is impressive, there are several weaknesses worth mentioning. First, word wrap is not available within report columns. This is an important feature to have because it allows you to reduce the width of longer fields and fit more fields on your report. The second, more frustrating weakness is the difficulty of "undoing" a format change. For instance, if you accidentally specify a total at the bottom of a column, there is no menu choice to let you remove the total. Your only option is to revert to what average report writers require—editing the report format file and removing that format command.

CUSTOM PROGRAMMING For users interested in developing custom application programs, *XDB* offers two options—a proprietary procedural language and interfaces to standard programming languages, including Pascal, C, and COBOL.

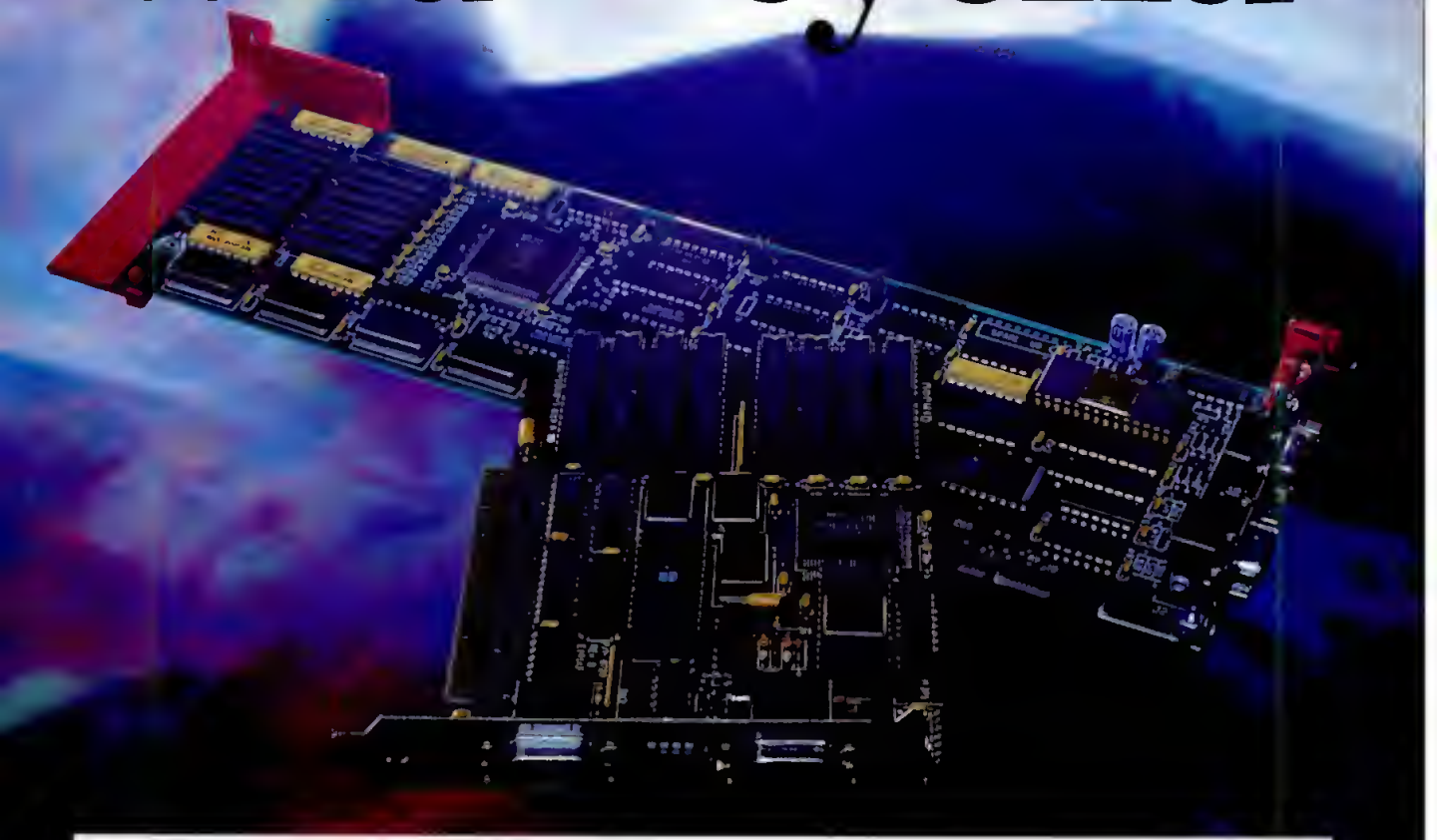
XDB's procedural language offers the essential programming functions and commands, such as If-Then statements, While loops, variables, arrays, calls to other procedure files, and even a compiler. Database operations are performed using SQL commands embedded in procedure files. To speed up menu creation, *XDB* provides a menu generator that is able to call your procedure files (or any DOS program).

XDB offers recovery utilities not normally found in microcomputer database systems. During your work session, *XDB* saves all transactions processed. If your database becomes corrupted, you can simply restore from your last backup and "replay" all transactions saved. A natural downside of this utility is that it can slow system performance because it must record your transactions to disk.

Documentation consists of several well-written reference manuals, an installation guide, and a learning guide containing lessons for the new user. One very frustrating flaw in the reference manuals is their abbreviated error-message explanations. In fact, there are no explanations; the manuals simply list the error messages. Is an error message supposed to make more sense when you read it in a book rather than on-screen?

For those interested in finding a top-rate SQL-based database system, *XDB* is certainly worth looking at. Speedy performance, a rich SQL implementation, and general ease of use make this package a winner.—**T. J. White** PC

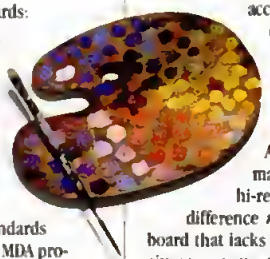
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RAMdisks can be a power user's dream or a memory-hogging nightmare. RECORDER gives you a painless way of checking disk file accesses so you can optimize RAMdisk use.

Power users are always looking for ways to squeeze just a little more speed out of their computers. Often, today, the limiting factor is the time spent waiting for the disk drive. Its mechanical operations just can't keep up with the speedy silicon of the microprocessor. A RAMdisk is one good answer to the problem of disk delays, since it provides a level of performance that can't be matched by the fastest hard disk in town. Another technique involves organizing the physical ordering of the sectors in such a way as to minimize head movement.

If you're not careful, however, these advanced techniques can sometimes do more harm than good. Your efforts to speed up the disk may slow down other operations, for example. Memory assigned to a RAMdisk is unavailable for executing programs. When usable memory is reduced, large programs often run inefficiently or (the worst case) not at all. Tuning the system for optimum performance thus requires precise balancing of your resources. And to do this, you've got to know exactly what your individual processing needs are.

RECORDER.COM will help you decide how to distribute your available resources. It measures your usage of disk I/O by keeping track of how many times each of your files is accessed. With this information in hand, you can select the specific files that will benefit most from being kept on the speedy RAMdisk. Moreover, if you use one of the disk optimization programs that let you locate files so as to minimize head movement, RECORDER will show you which files should be located closest to the FAT.

The easiest way to get a copy of RECORDER.COM is to download it from the PC Magazine Interactive Reader Service, as explained in the sidebar "RECORDER by Modem." Alternatively, you can create the .COM file either by assembling its source code, RECORDER.ASM, or by loading and running the RECORDER.BAS program. Both these listings are printed here and are also available for download from PC-IRS.

PRODUCTIVITY INDEX

UTILITIES
RECORDER says which files should go on a RAMdisk to improve speed.
ENVIRONMENTS
Rummaging through a dump of OS/2's "New Executable" file format.
POWER PROGRAMMING
Simple, smooth routines in C to format and display dates and times.
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PC TUTOR
Games that don't play by DOS's rules; accelerating slow memory.
CONNECTIVITY CLINIC
System log of *NetWare* users; *dBASE III* and *Clipper* go on the LAN.

USING RECORDER To begin logging your file activity, just load up RECORDER with the following command:

```
RECORDER [n] [/R]
```

The optional *n* parameter is used to specify the maximum number of filenames RECORDER will hold in its table. The default value, 200, is enough to handle a normal day's work, but you can increase the table size to a maximum of 2000 filenames, if necessary. Each additional entry requires 20 more bytes of RAM. The optional /R switch resets the table if it becomes filled. When you reset the table, all entries are erased and recording starts all over again. The /R is always ignored on the initial installation.

Once RECORDER is in place you just proceed with your normal PC work. Each time a file is accessed, it will be entered appropriately in a table similar to that shown in Figure 1. You can view this table any time you're at the DOS prompt simply by entering RECORDER again.

The data contained in the file table will allow you to optimize your disk operations. You'll notice right away, for example, that batch files generate a lot of disk activity. When DOS runs a batch file, it opens it, reads one line, closes it, then executes the line. This process is repeated until the entire file is processed. Since most

batch files are small in size but disk-intensive in use, they're ideal candidates for placement on a RAMdisk.

Chances are your program data files will also be at the top of RECORDER's list. It's a common practice to put them on the RAMdisk, as well. If you use this technique, however, you must be extra careful to copy these files back to your hard disk at reasonably frequent intervals and especially at the end of a session. Everything in RAM—including everything on a RAMdisk—disappears as soon as the machine is turned off or rebooted. If the system should crash with your latest masterpiece on the RAMdisk alone, you'll wish you'd never heard of such "time savers" as RAMdisks.

INTERPRETING THE TABLE The operating system assigns a series of numbered clusters to each file it stores. Each cluster is made up of one or more smaller units known as sectors. The sectors are the smallest unit of storage found on the disk. Sectors are arranged in groups called tracks, each track forming a ring. When a file is read, DOS figures out which sectors are needed and requests them from the disk controller. Each request requires the controller to position the head over the selected track. One request can read from one up to an entire track's worth of sectors. When the required sectors are scattered about on many tracks, multiple requests must be issued. The time required to complete the data transfer is largely a function of the number of individual requests made.

The numbers in the file table columns represent how many read or write requests were made to the device's controller. Every file that has been used since RECORDER was installed is listed. The read column is used each time a file is created, opened, or read from. The write column is used when a file is written to or closed.

The EXEC column is a little different. It shows the number of times a program was executed. Depending on its size, running a .COM or an .EXE program may actually require more than one actual disk access, though RECORDER increments the EXEC column by one regardless of the file size. The totals column is simply the sum of the other three.

You'll notice the filenames listed lack any drive and path designation. To keep RECORDER simple, all files with the same name are counted on the same line. If you have files in several directories with the same name, the table won't differentiate between them; this may be a good reason to get organized and get rid of the duplicates. [*Michael J. Mefford's REPEATS.COM, presented in this column in our June 9, 1987, issue, is ideal for identifying such files.—Ed.*]

When looking through the table, don't be surprised to see some filenames you've never heard of before. Many application programs create temporary files. They're normally deleted when the program terminates so you never know about them, but they don't escape RECORDER's watchful eye. Some programs, such as LINK.EXE, let you specify a drive letter for this type of scratch file. Your RAMdisk would be a perfect place for them. It's a shame more programs don't provide this feature.

The output table is normally sorted by descending order of the totals column, but you can easily sort it by any other column. For example, to sort by the EXEC column, just enter

```
RECORDER | SORT /+34
```

This command sequence uses piping and the DOS SORT utility to sort the table beginning with the 34th character. (The read column begins with character 20, and the write, with 27.) After using piping to sort the output, you'll notice still another strange file the next time you list the table. When DOS pipes output, it creates a temporary file in the root directory of the default disk. Different versions of DOS use different temporary filenames. Versions 2.*x* use names such as %PIPEn.$$$. Beginning with Version 3.0, the name consists of eight digits (such as 42621836). Although the names may seem random, they're actually derived from the system time.

The file table maintained by RECORDER isn't limitless. Should the message "*Table is saturated*" appear at the end of the listing, the table is filled. When this happens, no more entries can be added, although current entries will continue to be updated. The obvious thing to do is to reset the table. Before continuing, you'll probably want to save the current table entries. The easiest way to do this is to redirect its output into a file, thus:

```
RECORDER /R > FILES.LOG
```

This creates a copy of the table in the file FILES.LOG. At the same time, the /R option resets the table so you can start over again. If you find yourself filling the table

```
RECORDER 1.0 (c) 1987 Ziff Communications Co.
PC Magazine - Tom Kihlken

   File Name   Total    Read   Write    EXEC

RECORDER.ASM      88      88       0       0
   SETUP.ASM      69      65       4       0
   SETUP.COM      43      16      27       0
   SETUP.TMP      40       2      38       0
RECORDER.COM      17       3       9       5
RECORDER.EXE      13      13       0       0
 COMPILE.BAT      12      12       0       0
    EDIT.EXE       5       0       0       5
AUTOEXEC.BAT       4       4       0       0
    LINK.EXE       3       0       0       3
   DEBUG.COM       3       0       0       3
 EXE2COM.EXE       3       0       0       3
    MASM.EXE       2       0       0       2
```

Figure 1: *The report from RECORDER shows the number of times each file was read from, written to, or executed. The specific files shown on your display will differ.*

```
                Page 60,132
;--------------------------------------------------------------------------
; RECORDER.ASM - A resident program which counts file operations.
; Run it once to install and initialize it.  Run it again later to
; view a list of files which have been accessed.  The table
; shows how many disk accesses have been made while reading and
; writing to the file.
;
; SYNTAX:   RECORDER  [n] [/R]
; USE    n to specify the maximum number of files (default=200)
; Use  /R to reset the file table.
;--------------------------------------------------------------------------
CSEG            SEGMENT
                ASSUME  CS:CSEG,DS:NOTHING
                ORG     100H    ;Beginning for .COM programs
START:          JMP INITIALIZE  ;Initialization code is at end

;--------------------------------------------------------------------------
; Data area used by this program
;--------------------------------------------------------------------------
COPYRIGHT       DB      "RECORDER 1.0 (c) 1988 Ziff Communications Co."
PROGRAMMER      DB      13,10,"PC Magazine ",254," Tom Kihlken$",13H

FULL_MESS       DB      "*Table is saturated*$"
OLDINT21        DD      ?       ;Old DOS function interrupt vector
OLDINT13        DD      ?       ;Old BIOS disk I/O interrupt vector
NUM_FILES       DW      200     ;Default size of the table
FILE_TABLE_SIZ  DW      ?
LAST_FILE       DW      ?
LAST_HANDLE     DW      ?

;--to help count spaces--0123456789012345678901234567890123456789012345678901-----
HEADER          DB      "   File Name  Total   Read  Write   EXEC$"

CURRENT_FILE    DB      11 DUP (?)
CURRENT_HANDLE  DW      ?
FUNCTION_ID     DW      ?
BUSY_FLAG       DB      0
BIOS_IO_COUNT   DW      0       ;Counts disk accesses made by BIOS

HANDLE_TABLE    EQU     OFFSET INITIALIZE
FILE_TABLE      EQU     HANDLE_TABLE + NUM_HANDLES * 4
NUM_HANDLES     EQU     30
ENTRY_SIZE      EQU     20

;--------------------------------------------------------------------------
; Interrupt 13 (Diskette I/O) This routine counts disk sector accesses.
;--------------------------------------------------------------------------
NEWINT13        PROC    FAR
                ASSUME  DS:NOTHING, ES:NOTHING
                CMP     AH,2            ;Is function lower than 2?
                JB      DONT_COUNT      ;If yes, then ignore it
                CMP     AH,4            ;Is function higher than 4?
                JA      DONT_COUNT      ;If yes, then ignore it
                INC     CS:BIOS_IO_COUNT;Add sectors count to total
DONT_COUNT:
                JMP     CS:OLDINT13     ;Continue with disk interrupt
NEWINT13        ENDP

;--------------------------------------------------------------------------
; Interrupt 21 (DOS functions)  This routine counts file accesses.
;--------------------------------------------------------------------------
NEWINT21        PROC    FAR
                ASSUME  DS:NOTHING, SS:NOTHING

                PUSHF                   ;Save callers flags
                STI                     ;Get interrupts back on
                CMP     CS:BUSY_FLAG,0  ;Are we busy now?
                JNE     OLD_DOS         ;If busy, just pass it to Dos
                CMP     AH,4BH          ;Is it the EXEC function?
                JE      EXEC            ;Handle EXEC specially
                CMP     AH,0EH          ;Is it below 0EH?
                JBE     OLD_DOS         ;If yes, ignore it
                CMP     AH,31H          ;Is it TSR function?
                JE      OLD_DOS         ;Dont intercept this call
                CMP     AH,45H          ;Is it above 45H?
                JB      INTERCEPT_IT    ;If yes, then ignore it
OLD_DOS:
                POPF                    ;Recover callers flags
                CLI
                JMP     CS:OLDINT21     ;Allow interrupt to proceed
EXEC:
                PUSH    AX              ;Save these registers
                PUSH    BX
                PUSH    CX
                PUSH    SI
                PUSH    DI
                PUSH    DS
                PUSH    ES
                MOV     CS:BUSY_FLAG,1  ;Set the busy flag
                MOV     SI,OFFSET PARSE_STRING ;Point to parse routine
                CALL    ENTER_FILENAME  ;Search file table for the file
                JC      EXEC_CONTINUE
                INC     WORD PTR DS:[SI+12]
                INC     WORD PTR DS:[SI+14]
EXEC_CONTINUE:
                MOV     CS:BUSY_FLAG,0  ;Not busy any more
                POP     ES              ;Restore the registers
                POP     DS
                POP     DI
                POP     SI
                POP     CX
                POP     BX
                POP     AX
                JMP     OLD_DOS
INTERCEPT_IT:
                MOV     BUSY_FLAG,1     ;Ignore any other calls
                MOV     FUNCTION_ID,AX  ;Save the function ident.
                MOV     BIOS_IO_COUNT,0
                CLI
                CALL    CS:OLDINT21     ;Do the DOS function
                STI                     ;Reenable interrupts
                PUSHF                   ;Save DOS result flags
                PUSH    AX              ;Save these registers
                PUSH    BX
                PUSH    CX
                PUSH    DX
                PUSH    SI
                PUSH    DI
                PUSH    DS
                PUSH    ES
                JNC     CHECK_FUNCTION  ;If no error, continue
                JMP     POP_RET         ;Otherwise just return
CHECK_FUNCTION:
                MOV     CX,FUNCTION_ID
                SUB     CH,0FH          ;Is it 0Fh?
                JE      READ_FCB
                DEC     CH              ;Is it 10h?
                JE      WRITE_FCB
                SUB     CH,4            ;Is it 14h?
                JE      READ_FCB
                DEC     CH              ;Is it 15h?
                JE      WRITE_FCB
                DEC     CH              ;Is it 16h?
                JE      READ_FCB
                SUB     CH,0BH          ;Is it 21h?
                JE      READ_FCB
                DEC     CH              ;Is it 22h?
                JE      WRITE_FCB
                DEC     CH              ;Is it 23h?
                JE      READ_FCB
                SUB     CH,4            ;Is it 27h?
                JE      READ_FCB
                DEC     CH              ;Is it 28h?
                JE      WRITE_FCB
                JMP     SHORT NOT_FCB_FUNCTN
READ_FCB:
                MOV     SI,14           ;Index for the read column
                JMP     SHORT INC_FCB_COUNT
WRITE_FCB:
                MOV     BX,16           ;Index for the write column
INC_FCB_COUNT:
                MOV     SI,OFFSET PASSE_FCB
                CALL    ENTER_FILENAME  ;Search file table for the file
                JC      JUMP_POP_RET    ;Quit if file not in table
                MOV     AX,BIOS_IO_COUNT;This many disk operations made
                ADD     CS:[SI][BX],AX  ;Add it to the indexed column
                ADD     CS:[SI+12],AX   ;Add it to the total
                JMP     POP_RET

; If it was not a FCB function, see if it was handle I/O

NOT_FCB_FUNCTN:
                SUB     CH,14H          ;Is it 3Ch?
                JE      NEW_HANDLE
                DEC     CH              ;Is it 3Dh?
                JE      NEW_HANDLE
                DEC     CH              ;Is it 3Eh?
                JE      WRITE_HANDLE
                DEC     CH              ;Is it 3Fh?
                JE      READ_HANDLE
                DEC     CH              ;Is it 40h?
                JE      WRITE_HANDLE
                SUB     CH,2            ;Is it 42h?
                JE      READ_HANDLE
                SUB     CH,2            ;Is it 44h?
                JE      IO_CONTROL
                JMP     POP_RET
NEW_HANDLE:
                CMP     AX,5            ;Is it a standard handle?
                JGE     GOOD_HANDLE     ;If not, then record it
JUMP_POP_RET:

                JMP     POP_RET         ;Jump to the return
READ_HANDLE:
                MOV     CX,14           ;Index for the read column
                JMP     SHORT INC_DEV_COUNT
IO_CONTROL:
                CMP     CL,2            ;Is it a read request?
                JE      READ_HANDLE     ;Treat it as a read
                CMP     CL,3            ;Is it a write request?
                JNE     JUMP_POP_RET    ;If not read or write, ignore it
WRITE_HANDLE:
                MOV     CX,16           ;Index for the write column
INC_DEV_COUNT:
                CMP     SI,5            ;Is it a standard handle?
                JB      JUMP_POP_RET    ;If it is, then ignore it
```

(continues)

RECORDER.ASM: *The assembly language source code for RECORDER.COM.*

```
                PUSH    CX              ;Put index on the stack

; Now search the handle table for the handle in BX.

                CALL    ADD_PSP         ;Add in the current PSP segment
                MOV     DI,HANDLE_TABLE ;Point to the handle table
                MOV     CX,NUM_HANDLES  ;Search the entire table
HANDLE_LOOP:
                CMP     BX,CS:[DI]      ;Is it a match?
                JE      HANDLE_MATCH    ;If it is, we've found it
                ADD     DI,4            ;If not, look at next entry
                LOOP    HANDLE_LOOP
                POP     BX              ;Restore the stack
                JMP     SHORT POP_RET   ;Return if handle was not found

; If the handle is being closed, then the entry is deleted.

HANDLE_MATCH:
                CMP     BYTE PTR FUNCTION_ID+1,3EH ;Closing this file?
                JNE     NOT_CLOSE
                MOV     BORD PTR CS:[DI],0
NOT_CLOSE:
                MOV     DI,CS:[DI+2]    ;Get pointer to file table entry
                POP     AX              ;Get the index back
                MOV     AX,BIOS_ID_COUNT ;Get the sector count
                ADD     CS:[DI][AX],AX  ;Add it to selected column
                ADD     CS:[DI+12],AX   ;And also to the total column
                JMP     SHORT POP_RET
GOOD_HANDLE:
                MOV     CURRENT_HANDLE,AX       ;Save the handle
                MOV     SI,OFFSET PARSE_STRING  ;Point to parse routine
                CALL    ENTER_FILENAME  ;Add the file to the table
                JC      JUMP_POP_RET    ;If table is full, return
                MOV     AX,BIOS_ID_COUNT;Get number of sectors
                ADD     DX:[SI+12],AX   ;Add to the total column
                ADD     DS:[SI+14],AX   ;Add to the read column

; Now enter this new handle to the handle table

                MOV     DI,LAST_HANDLE  ;Get location of last entry
                ADD     DI,4            ;Advance it one position
                CMP     DI,HANDLE_TABLE+NUM_HANDLES*4
                JNE     KEEP_GOING
                MOV     DI,HANDLE_TABLE
KEEP_GOING:
                MOV     LAST_HANDLE,DI    ;Now this is the last handle
                MOV     AX,CURRENT_HANDLE ;Get handle back

                CALL    ADD_PSP         ;Add in the current PSP segment
                MOV     CS:[DI],BX      ;Store the handle
                MOV     CS:[DI+2],SI    ;Store location in file table
POP_RET:
                MOV     CS:BUSY_FLAG,0  ;Not busy any more
                POP     AX              ;Restore all registers
                POP     DS
                POP     DI
                POP     SI
                POP     DX
                POP     CX
                POP     BX
                POP     AX
                POPF                    ;Recover DOS result flags
                RTI                     ;Return with interrupts on
                RET     2               ;Return with these flags
REWIRT21        ENDP

;-------------------------------------------------------------------
; ENTER_FILENAME adds the file at DS:DX to the table.
; It returns with DS:SI pointing to the entry.  If CF=1, then the name
; was not in the table and no more entries could be added.
;-------------------------------------------------------------------

                ASSUME  DS:NOTHING, ES:CSEG
ENTER_FILENAME  PROC    NEAR
                CLD                     ;String moves forward
                PUSH    CS              ;Set up the ES register
                POP     ES

                MOV     DI,OFFSET CURRENT_FILE
                MOV     AL," "          ;Fill with blanks
                MOV     CX,11           ;11 letters in name
                REP     STOSB

                CALL    SI              ;Call the parse routine

; Now search the file table for the current filename
                CLD
                PUSH    CS
                POP     DS              ;Set DS to this segment
                ASSUME  DS:CSEG
                MOV     CX,NUM_FILES    ;Try all entries
                MOV     SI,FILE_TABLE   ;Setup for a string compare
SEARCH_LOOP:
                MOV     DI,OFFSET CURRENT_FILE
                PUSH    CX              ;Save the loop counter
                PUSH    SI              ;Save the source also
                MOV     CX,11           ;Compare 11 characters
                REPE    CMPSB           ;Do they all match?
                POP     SI
                POP     AX              ;Recover loop counter
                JCXZ    CLEAR_RETURN    ;If matched, return CF=0
                ADD     SI,ENTRY_SIZE   ;Point to next name in table
                MOV     CX,AX           ;Get loop counter back to CX
                LOOP    SEARCH_LOOP
                MOV     DI,LAST_FILE    ;Get location of last entry
                CMP     DI,-1           ;Is table saturated?
                JE      TABLE_FULL      ;If yes, then return

                MOV     CX,NUM_FILES    ;Loop through file table
FIND_OLDEST:
                ADD     DI,ENTRY_SIZE   ;Point to next entry in table
                CMP     DI,FILE_TABLE_END
                JB      NO_WRAP
                MOV     DI,FILE_TABLE
NO_WRAP:
                MOV     AX,[DI+12]      ;Get total for this record
                CMP     AX,1            ;Is it less than one?
                JBE     FOUND_OLDEST    ;If it is, then we'll use it
                LOOP    FIND_OLDEST     ;Search entire table for a space
                MOV     LAST_FILE,-1    ;If none found, table is full
TABLE_FULL:
                STC                     ;Carry flag indicates table full
                RET

; At this point ES:DI points to newest table entry

FOUND_OLDEST:
                MOV     LAST_FILE,DI
                PUSH    DI
                CLD                     ;String moves forward
                MOV     SI,OFFSET CURRENT_FILE
                MOV     CX,11           ;Copy the filename to table
                REP     MOVSB           ;Move the string in
                XOR     AX,AX
                INC     DI              ;Point to the totals column
                STOSW                   ;Set total column to zero
                STOSW                   ;Set open column to zero
                STOSW                   ;Set read column to zero
                STOSW                   ;Set write column to zero
                STOSW
                POP     SI
CLEAR_RETURN:
                CLC                     ;Indicates sucessful return
                RET
ENTER_FILENAME  ENDP

;-------------------------------------------------------------------
; This subroutine parses a filename from the FCB at DS:DX
;-------------------------------------------------------------------
                ASSUME  DS:NOTHING, ES:CSEG
PARSE_FCB       PROC    NEAR
                INC     DX              ;Point to filename in FCB
                MOV     SI,DX           ;Get address in index register
                ADD     SI,8            ;Point to file extension
                MOV     DI,OFFSET CURRENT_FILE+8 ;DI Points to extension
                MOV     CX,3
COPY_EXT_1:
                LODSB                   ;Get a letter of the extension
                CALL    UPPER_CASE      ;Make it upper case
                STOSB                   ;Store it in current file
                LOOP    COPY_EXT_1
                SUB     SI,3
                JMP     SHORT COPY_NAME ;Finish copying the name
                RET
PARSE_FCB       ENDP

;-------------------------------------------------------------------
;This routine parses an ASCII filename from DS:DX and places it at
; CURRENT_FILE
;-------------------------------------------------------------------
PARSE_STRING    PROC    NEAR

                ASSUME  DS:NOTHING, ES:CSEG
                MOV     SI,DX           ;Get address in index register
LOOK_FOR_DOT:
                LODSB                   ;Next letter of name
                OR      AL,AL           ;Is it the last letter
                JE      COPY_NAME1 ;If yes, begin to copy the name
                CMP     AL,"."          ;Is this the dot?
                JNE     LOOK_FOR_DOT
DOT_THE_DOT:
                PUSH    SI              ;Now SI points to the extension
                MOV     DI,OFFSET CURRENT_FILE+8 ;DI points to extension
                MOV     CX,3
COPY_EXTENSION:
                LODSB                   ;Next letter of the extension
                OR      AL,AL           ;Is it the last letter?
                JZ      END_COPY
                CALL    UPPER_CASE      ;Convert letter to upper case
                STOSB                   ;And store it
                LOOP    COPY_EXTENSION
END_COPY:
                POP     SI              ;Recover location of name
COPY_NAME1:
                DEC     SI
COPY_NAME:
                DEC     SI
                STD                     ;Copy name right to left
                MOV     CX,8            ;Eight letters in filename
                MOV     DI,OFFSET CURRENT_FILE+7 ;Point to end of name
NAME_LOOP:
                CMP     SI,DX           ;At start of name yet?
                JB      PARSE_DONE      ;If yes, then quit copying
```

(RECORDER.ASM continues)

```
                LODSB                   ;Get letter of name
                CMP     AL,"\"          ;At path specification?
                JE      PARSE_DONE      ;If yes, then quit copying
                CMP     AL,"/"          ;At path specification?
                JE      PARSE_DONE      ;If yes, then quit copying
                CMP     AL,":"          ;At drive specification?
                JE      PARSE_DONE      ;If yes, then quit copying
                CMP     AL," "          ;Is this letter a space?
                JE      SKIP_SPACE      ;Don't copy any spaces
                CALL    UPPER_CASE      ;Convert letters to upper case
                STOSB                   ;Store the letter
SKIP_SPACE:
                CMP     SI,0FFFFH       ;Did SI wrap around segment?
                JE      PARSE_DONE      ;If yes, then quit copying
                LOOP    NAME_LOOP ;Loop through entire name
PARSE_DONE:
                RET                     ;Done parsing the name
PARSE_STRING    ENDP

;---------------------------------------------------------------------
; This subroutine converts the letter in AL to upper case.
;---------------------------------------------------------------------
UPPER_CASE      PROC    NEAR
                ASSUME  DS:NOTHING, ES:NOTHING
                CMP     AL,"a"          ;Is it lower case?
                JB      NO_CHANGE       ;If not, don't change it
                CMP     AL,"z"          ;Is it a letter?
                JA      NO_CHANGE       ;If not, don't change it
                AND     AL,11011111B    ;This convert to upper case
NO_CHANGE:      RET
UPPER_CASE      ENDP

;---------------------------------------------------------------------
; This subroutine adds the current PSP segment address to the handle
; in BX.  This creates a unique number for each open handle.
;---------------------------------------------------------------------
ADD_PSP         PROC    NEAR
                ASSUME  DS:NOTHING, ES:NOTHING
                PUSH    BX              ;Save the starting handle
                MOV     AH,51H          ;Get current PSP
                INT     21H
                POP     AX              ;Get back starting handle
                ADD     BX,AX           ;And add it to the PSP
                RET
ADD_PSP         ENDP

;---------------------------------------------------------------------
; This subroutine zeroe out the file and handle tables.
; On entry DS points to the tables segment.
;---------------------------------------------------------------------
RESET_TABLE     PROC    NEAR
                ASSUME  DS:NOTHING, ES:NOTHING
                PUSH    DS
                POP     ES
                MOV     DI,FILE_TABLE
                MOV     CX,DS:NUM_FILES
                XOR     AX,AX
ZERO_FILES:
                STOSW                   ;Erase the old filename
                ADD     DI,18
                STOSW                   ;Zero the total count
                ADD     DI,ENTRY_SIZE-14
                LOOP    ZERO_FILES
                MOV     DI,HANDLE_TABLE ;Point to the handle table
                MOV     CX,NUM_HANDLES  ;Number of entries in it.
ZERO_HANDLES:
                XOR     AX,AX
                STOSW
                MOV     AX,FILE_TABLE
                STOSW
                LOOP    ZERO_HANDLES    ;Zero the handle table entries
                MOV     LAST_FILE,FILE_TABLE
                MOV     LAST_HANDLE,HANDLE_TABLE
                RET
RESET_TABLE     ENDP

;---------------------------------------------------------------------
; To install, store existing interrupt vectors and replace them with the
; new ones.  They exit and remain resident.
;---------------------------------------------------------------------
INSTALL:
                ASSUME  CS:CSEG, DX:CSEG, BX:NOTHING
                CALL    LOAD_PARAMS
                JCXZ    NO_DIGITS
                XOR     AX,AX           ;Clear AX for the total
GET_DIGIT:
                MOV     BL,DS:[SI]      ;Get next letter
                SUB     BL,30H          ;Convert ascii to integer
                JC      NOT_A_DIGIT     ;Was it below a 0?
                CMP     BL,9            ;Was it above a 9?
                JA      NOT_A_DIGIT     ;Ignore if not 0-9
                MOV     BH,10
                MUL     BX              ;Times 10 for next digit
                XOR     BH,BH
                ADD     AX,BX           ;Add in the new digit
NOT_A_DIGIT:
                INC     SI
                LOOP    GET_DIGIT       ;Look at all characters
                OR      AX,AX           ;Did we get anything
                JE      NO_DIGITS
                CMP     AX,2000         ;Above the upper limit?
                JBE     SIZE_OK
                MOV     AX,2000
SIZE_OK:
                MOV     NUM_FILES,AX
NO_DIGITS:
                MOV     AX,3513H        ;Get DOS disk I/O vector
                INT     21H
                MOV     WORD PTR [OLDINT13]  ,BX
                MOV     WORD PTR [OLDINT13+2],ES
                MOV     DX, OFFSET NEWINT13
                MOV     AX, 2513H

                INT     21H             ;DOS function to change vector
                MOV     AX,3521H        ;Get DOS function vector
                INT     21H
                MOV     WORD PTR [OLDINT21]  ,BX
                MOV     WORD PTR [OLDINT21+2],ES
                MOV     DX, OFFSET NEWINT21
                MOV     AX, 2521H
                INT     21H             ;DOS function to change vector

;---------------------------------------------------------------------
; Deallocate our copy of the enviornment.
; Exit using INT 27H. Leave code and space for the tables resident.
;---------------------------------------------------------------------

                CALL    RESET_TABLE     ;Clear out the file table
                MOV     AX,DS:[002CH]   ;Get segment of enviornment
                MOV     ES,AX           ;Put it into ES
                MOV     AH,49H          ;Release enviornment segment
                INT     21H

                MOV     AX,NUM_FILES    ;Get number of files
                MOV     BX,ENTRY_SIZE   ;Times size of each entry
                MUL     BX
                ADD     AX,FILE_TABLE   ;Add in beginning of table
                MOV     FILE_TABLE_END,AX
                ADD     AX,15
                MOV     CL,4
                SHR     AX,CL
                MOV     DX,AX           ;Leave this much resident
                MOV     AX,3100H
                INT     21H             ;Terminate and stay resident

;---------------------------------------------------------------------
; Here is the code used to initialize RECORDSS.COM.  First determine
; if RECORDSS is already installed.
;---------------------------------------------------------------------
                ASSUME  CS:CSEG, DX:CSEG, BX:NOTHING
EVEN                                    ;Align to an even byte boundary

INITIALIZE:
                ASSUME  DS:CSEG, ES:NOTHING
                MOV     DX,OFFSET COPYRIGHT
                CALL    MSTRING_CALP    ;Display the string

; Search for a previously installed copy of RECORDSS

                NOT     WORD PTR MSTART ;Modify to avoid false match
                XOR     BX,BX           ;Start search at segment zero
                MOV     AX,CS           ;Compare to this code segment
NEXT_SEGMENT:
                INC     BX              ;Look at next segment
                CMP     AX,BX           ;Until reaching this segment
                MOV     ES,BX
                JNE     NOT_FOUND
                JMP     INSTALL
NOT_FOUND:
                MOV     SI,OFFSET START ;Setup to compare strings
                MOV     DI,81
                MOV     CX,16           ;16 bytes must match
                REP     CMPSB           ;Compare DS:SI to ES:DI
                OR      CX,CX
                JNZ     NEXT_SEGMENT    ;If no match, try next segment

; When all 16 bytes match, an installed copy already exists and
; ES points to resident code segment. Display the file table

                PUSH    ES
                POP     DS              ;DS also points to table
                ASSUME  DS:NOTHING, ES:NOTHING

                MOV     DI,FILE_TABLE   ;Point to the table
                MOV     CX,DS:NUM_FILES ;Number of entries in table
ZERO_LOOP:
                MOV     BYTE PTR [DI+11],0 ;Zero the displayed byte
                ADD     DI,ENTRY_SIZE   ;Move to next entry
                LOOP    ZERO_LOOP       ;Do entire table

                CALL    NEW_LINE
                MOV     DX,OFFSET HEADER;Point to header text
                CALL    STRING_CALP     ;Display the string
                MOV     CX,DS:NUM_FILES ;Number of entries in table
FILE_LOOP:
                PUSH    CX
                MOV     DI,FILE_TABLE   ;Point to the table
                XOR     AX,AX
                MOV     CX,DS:NUM_FILES ;Number of entries in table
FIND_BIGGEST:
                CMP     [DI+12],AX
                JBE     NOT_BIGGER
                CMP     BYTE PTR [DI+11],0
```

(RECORDER ASM continues)

■ UTILITIES

```
                JNZ     NOT_BIGGES
                MOV     SI,DI
                MOV     AX,[SI+12]
NOT_BIGGE0:
                ADD     DI,ENTRY_SIZE
                LOOP    FIND_BIGGEST

                CMP     BYTE PTR [SI+11],I
                JZ      LAST_ONE
                MOV     BYTE PTR [SI+11],I
                MOV     DX,SI
                ADD     SI,12
                CMP     WORD PTR [SI],0
                JE      LAST_ONE
                MOV     AX,405
                MOV     BX,I
                MOV     CX,8            ;8 letters in name
                IST     2IS
                PUSS    De
                MOV     AL,"."          ;Display e dot
                CALL    DISPLAY_CHAR
                POP     DX
                ADD     DX,8            ;Now point to eetensios
                MOV     AX,405
                MOV     CX,3            ;3 letters in extension
                IST     2IS
                LOOSW
                PUSS    AX              ;Save the totsl
                CALL    NUMBER_OUT      ;Display the totels column
                LOOSW
                CALL    SUMBRS_OUT
                LODSW
                CALL    NUMBER_OUT
                LOOSS
                CALL    NUMBER_OUT
                CALL    SEW_LIBE
                POP     AX              ;Recover the totel count
                POP     CX
                LOOP    FILE_LOOP
                CMP     AX,2            ;See the leet totel lese than 2?
                JB      LAST_ONE        ;If yee, table is not full yet.
                CALL    eew_LINE
                MOV     DX,OFFSET FULL_MESS
                CALL    STRING_CRLF     ;Display the string
LAST_ONE:
                CALL    LOAD_PARAMS
                JCXZ    NO_PARAMS
SCAN_PARAMS:
                MOV     AL,CS:[SI]
                OR      AL,32           ;Coevert it to lower cass
                CMP     AL,"r"          ;Is it the s parameter?
                JE      SLASH_e         ;If yee, thee reset the table
                ISC     SI
                LOOP    SCAN_PARAMS     ;Look et ell parametere
NO_PARAMS:
                MOV     AX,4C00H
                INT     21H
SLASH_S:
                CALL    RESET_TABLE
                JMP     NO_PARAMS

;-------------------------------------------------------------------
; SUMBRS_OUT Outputs the oumber in AX to the etandard output device
;-------------------------------------------------------------------
NUMBER_OUT      PROC    NEAR
                PUSH    AX              ;Save the oumber
                MOV     AL," "          ;Send e epace
                CALL    DISPLAY_CHAR    ;Write the cheracter
                MOV     AL," "          ;Send eoother space
                CALL    DISPLAY_CHAR    ;Write the cheracter
                POP     AX
                XOR     CX,CX           ;Indicetes no digit yet

                MOV     BX,10000        ;Get 10000's digit
                CALL    DIVIDE_OUT      ;Display it
                MOV     BX,1000         ;Get 1000's digit
                CALL    DIVIDE_OUT      ;Display it
                MOV     BX,100          ;Get 100's digit
                CALL    DIVIDE_OUT      ;Display it
                MOV     BX,10           ;Get 10's digit
                CALL    DIVIDE_OUT      ;Display it

                ADD     AL,30H          ;Get I's digit
                CALL    DISPLAY_CHAR    ;Display the leet character
                RET
NUMBER_OUT      ENDP

;-------------------------------------------------------------------
; This divides AX by BX and displays the result. Remainder is in AX.
;-------------------------------------------------------------------
DIVIDE_OUT      PROC    NEAR
                XOR     DX,DX
                DIV     BX              ;Divide to get this digit
                PUSH    DX              ;Seve the remainder
                OR      CX,AX
                OR      CX,CX           ;Any digits yet?
                JNZ     GOT_A_SPACE
                MOV     AL," "-30H
GOT_A_SPACE:
                ADD     AL,30H          ;Convert it to ASCII
                PUSH    CX
                CALL    DISPLAY_CHAR    ;Write the character
                POP     CX
                POP     AX              ;Get the remainder back
                RET
DIVIDE_OUT      ENDP

;-------------------------------------------------------------------
; DISPLAY_CHAR outputs the character in AL to the standard output device
;-------------------------------------------------------------------
DISPLAY_CHAR    PROC    NEAR
                MOV     DL,AL           ;Get the character into DL
                MOV     AH,02           ;DOS string output function
                INT     21H
                RET
DISPLAY_CHAR    ENDP

;-------------------------------------------------------------------
; STRING_CR displays a string followed by a CR and LF
; Entry point NEW_LINE displays only the CR and LF
;-------------------------------------------------------------------
STRING_CRLF     PROC    NEAR
                MOV     AH,9            ;Display string function
                INT     21H
NEW_LINE:
                MOV     AL,13           ;The carriage return
                CALL    DISPLAY_CHAR    ;Send it
                MOV     AL,10           ;The line feed
                CALL    DISPLAY_CHAR    ;Send it
                RET
STRING_CRLF     ENDP

;-------------------------------------------------------------------
; This subroutine sets DI to the command line and CX to the byte count
;-------------------------------------------------------------------
LOAD_PARAMS     PROC    NEAR
                MOV     SI,80H          ;Point to parameter area
                MOV     CL,CS:[SI]      ;Get number of chars into CL
                OR      CH,CH           ;Make it a word
                INC     SI              ;Point to first character
                CLD                     ;String search forward
                RET
LOAD_PARAMS     ENDP

CSEG            ENDS
                END     START
```

(RECORDER.ASM ends)

frequently, just specify a larger table size the next time you load RECORDER.

After studying the list, you're ready to begin tuning your disk. Files with the highest totals are prime candidates for RAMdisks. If you're not already familiar with using a virtual disk, the sidebar "Shifting into High Gear with VDISK" will show you how it works. Other often-used files (especially those too large to keep in RAM) should ideally be located on the outermost sectors. When selecting files for this prestigious perch, choose only those that won't be modified, such as executable programs. When a file is copied or deleted its sectors get reallocated by DOS, destroying the continuity you're trying to achieve. The reason the outer sectors are fastest is because the file allocation table is also located there. Files located closest to the FAT can be read with the least amount of head movement.

Rearranging a hard disk is best done with one of the specialized disk management utilities. As an alternative, you can copy all your files to floppies, reformat the hard disk, then copy the files back in the order of highest utilization. Since you'll be replacing the files one by one, be sure to keep an accurate record of the directory structure. If you take this approach, this would be a good time to get rid of all your duplicate and obsolete files as well. Directories full of unnecessary files slow the operating system as it searches for good files. Before reformatting the disk, be sure to make a second, complete backup as double insurance against lost files.

DOS FILE HANDLING The Disk Operating System is king when it comes to putting data on the polished platters. Al-

though some programs (such as *The Norton Utilities*) are smart enough to write to disk by themselves, most are not. The DOS services (including file I/O) are accessed by software interrupt 21h. The location of the interrupt 21h service routine is located at address 0000:0084h. By modifying this vector, RECORDER can monitor every DOS function request. The functions available with this powerful interrupt are well documented in the DOS *Technical Reference* manual. RECORDER watches for those that concern file I/O and extracts the vital information it needs from the registers. These functions are summarized in the table "DOS File Functions."

As the table indicates, DOS uses two different systems in handling files. The first is somewhat old-fashioned and dates back to the time when DOS was evolving from the CP/M operating system. It uses a system of file control blocks (FCBs) and data transfer areas (DTAs). The FCB is a block of information in memory that DOS needs to locate the required file sectors. A separate FCB is needed for each open file.

■ FCB functions were made obsolete with DOS 2.0. Since they're still used by older software, RECORDER must be able to work with them.

The layout for an FCB is shown in the diagram "File Control Block Fields." Some of the data (such as the name and extension) for the FCB is provided by the requesting program. The remainder is supplied by DOS when the file is opened. The only part of interest to RECORDER is the filename and extension. The DTA is a chunk of memory into which and out of which the disk controller transfers information directly. Its location is always controlled by the requesting program.

FCB functions don't support subdirectories and so were made obsolete with DOS 2.0. Since they're still used by older software, however, RECORDER must be able to work with them.

Newer programs use identifiers known as handles to refer to files. Each time a file is opened, a 16-bit binary value is assigned to it. The handle is then used to refer to the

```
100 REM -- BASIC PROGRAM TO CREATE RECORDER.COM
110 OPEN "RECORDER.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I = 1 TO  164
150    LINESUM = 0
155    PRINT ".";
160    FOR J = 1 TO 8
170       READ BYTE
180       CSECKSUM = CHECKSUM + BYTE
190       LINESUM = LINESUM + BYTE
200       IF (BYTE < 256) THEN LSET A$ = CHR$(BYTE)
210       PUT #1
220    NEXT J
230    READ LINECHECK
240    IF LINECHECK <> LINESUM THEN PRINT "Error in Line";200 + 10 * I
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 131024 THEN PRINT "Successful Completion!" : END
280 PRINT "COM file is not valid!" : END
290 DATA    233,    227,      3,     82,     69,     67,     79,     92,    842
300 DATA     68,     69,     82,     32,     49,     46,     48,     32,    426
310 DATA     48,     99,     41,     32,     49,     57,     56,     56,    430
320 DATA     32,     90,    105,    102,    102,     32,     67,    111,    641
330 DATA    106,    109,    117,    119,    105,     99,     97,    116,    962
340 DATA    105,    111,    118,    115,     32,     67,    111,     46,    697
350 DATA     12,     10,     68,     67,     32,     77,     97,    103,    479
360 DATA     67,    122,    105,    110,    101,     32,    254,     32,    953
370 DATA     84,    111,    109,     22,     75,    105,    104,    100,    728
380 DATA    107,    101,    110,     36,     26,     42,     84,     97,    603
390 DATA     98,    100,    101,     32,    105,    115,     22,    115,    706
400 DATA     97,    116,    117,    114,     97,    116,    101,    100,    858
410 DATA     42,     36,      0,      0,      0,      0,      9,      0,     76
420 DATA      0,      0,    206,      0,      0,      0,      0,      0,    206
430 DATA      0,      0,     32,     32,     32,     70,    105,    109,    379
440 DATA    101,     32,     70,     97,    109,    101,     32,     32,    582
450 DATA     84,    111,    116,     67,    100,     32,     32,     32,    612
460 DATA     82,    101,     67,    100,     32,     22,     87,    114,    645
470 DATA    105,    116,    101,     32,     32,     32,     69,     80,    575
480 DATA     69,     67,     36,      0,      0,      0,      0,      0,    172
490 DATA      0,      0,      0,      0,      0,      0,      0,      0,      6
500 DATA      0,      0,      6,      0,      0,    128,    252,      2,    382
510 DATA    114,     10,    128,    252,      4,    119,      5,     46,    670
520 DATA    255,      6,    171,      1,     46,    255,     46,    102,    682
530 DATA      1,    156,    251,     46,    128,     62,    170,      1,    815
540 DATA      0,    117,     20,    120,    252,     75,    116,     22,    730
550 DATA    128,    252,     14,    110,     10,    120,    252,     49,    951
560 DATA    116,      5,    128,    252,     66,    114,     49,    157,    890
570 DATA    259,     46,    255,     46,     98,      1,     88,     83,    859
580 DATA     81,     86,     87,     30,      6,     46,    198,      6,    540
590 DATA    170,      1,      1,    198,    215,      3,    232,     83,    895
600 DATA      1,    114,      6,    255,     68,     12,    255,     60,    779
610 DATA     10,     46,    166,      6,    170,      1,      0,      7,    446
620 DATA     31,     95,     64,     89,     91,     66,    235,    207,    930
630 DATA     46,    166,      6,    170,      1,      1,     46,    163,    631
640 DATA    160,      1,     46,    199,      6,    171,      1,      0,    592
650 DATA      0,    250,     46,    255,     38,     98,      1,    251,    931
660 DATA    156,     98,     83,     81,     82,     86,     87,     20,    685
670 DATA      6,    115,      3,    233,      3,      1,     46,    139,    546
680 DATA     14,    166,      1,    120,    237,     15,    116,     41,    720
690 DATA    254,    205,    116,     42,    128,    237,      4,    116,   1102
700 DATA     32,    254,    205,    116,     22,    254,    205,    116,   1215
710 DATA     24,    128,    237,     11,    116,     19,    254,    205,    694
720 DATA    116,     20,    254,    205,    116,     11,    128,    237,   1007
730 DATA      4,    116,      6,    254,    205,    116,      7,    235,    942
740 DATA     38,    167,     14,      6,    235,      3,    107,     16,    672
750 DATA      0,    166,    160,      3,    232,    212,      0,    114,    642
760 DATA     53,     46,    161,    171,      1,     46,      1,      0,    479
770 DATA     46,      1,     60,     12,    233,    170,      0,    120,    666
780 DATA    237,     20,    116,     29,    254,    205,    116,     25,   1002
790 DATA    254,    205,    116,     44,    254,    205,    116,     25,   1219
800 DATA    254,    205,    116,     36,    120,    237,      2,    116,   1094
810 DATA     16,    120,    237,      2,    116,     16,    233,    144,    892
820 DATA      0,     61,      5,      0,    125,     98,    233,    136,    648
830 DATA      0,    165,     14,      0,    235,     13,    120,    249,    824
840 DATA      2,    116,    246,    120,    249,      3,    117,    236,   1099
850 DATA    105,     16,      0,    131,    251,      5,    114,    230,    932
860 DATA     61,    232,     64,      1,    191,    230,      4,    105,   1010
870 DATA     30,      0,     46,     59,     29,    116,      0,    131,    419
880 DATA    199,      4,    226,    246,     91,    235,     98,     46,   1137
890 DATA    128,     62,    169,      1,     62,    117,      5,     46,    598
900 DATA    199,      5,      0,      0,     46,    139,    125,      2,    516
910 DATA     91,     46,    161,    171,      1,     46,      1,      1,    518
920 DATA     46,      1,     69,     12,    235,     59,     46,    162,    631
930 DATA    166,      1,    198,    215,      3,    232,     68,      0,    875
940 DATA    114,    164,     46,    161,    171,      1,      1,     66,    726
950 DATA     12,      1,     66,     14,     46,    136,     62,    112,    454
666 DATA      1,    131,    169,      4,    129,    255,     94,      5,    819
970 DATA    117,      3,    191,    230,      4,     46,    137,     62,    798
980 DATA    112,      1,     46,    139,     30,    166,      1,    232,    727
990 DATA    248,      0,     46,    127,     29,     46,    137,    117,    766
1000 DATA     2,     46,    160,      6,    170,      1,      0,      7,    430
1010 DATA    31,     95,     94,     90,     89,     91,     88,    157,    735
1020 DATA    251,    202,      2,      0,    252,     14,      7,    191,    919
1030 DATA    155,      1,    176,     32,    105,     11,      0,    243,    803
1040 DATA    170,    255,    214,    252,     14,     31,    139,     14,   1006
1050 DATA    106,      1,    198,     94,      5,    191,    155,      1,    743
1660 DATA     81,     86,    165,     11,      0,    243,    166,     94,    966
1070 DATA     60,    227,     73,    131,    198,     20,    139,    208,   1076
1080 DATA    226,    225,    129,     62,    110,      1,    131,    255,   1159
1090 DATA    255,    116,     22,    139,     14,    106,      1,    131,    794
1100 DATA    166,     20,     56,     62,    106,      1,    114,      3,    566
1110 DATA    191,     94,      9,    139,     69,     12,     61,      1,    572
1120 DATA      6,    110,     10,    226,    234,    199,      6,    110,    983
1130 DATA      1,    255,    255,    249,    195,    137,     62,    110,   1264
1140 DATA      1,     87,    252,    198,    155,      1,    105,     11,    802
1150 DATA      0,    243,    164,     51,    192,     71,    171,    171,   1063
1160 DATA    171,    171,    171,     64,    240,    165,     66,    139,   1255
1170 DATA    242,    131,    196,      8,    191,    163,      1,    105,   1119
```

(continues)

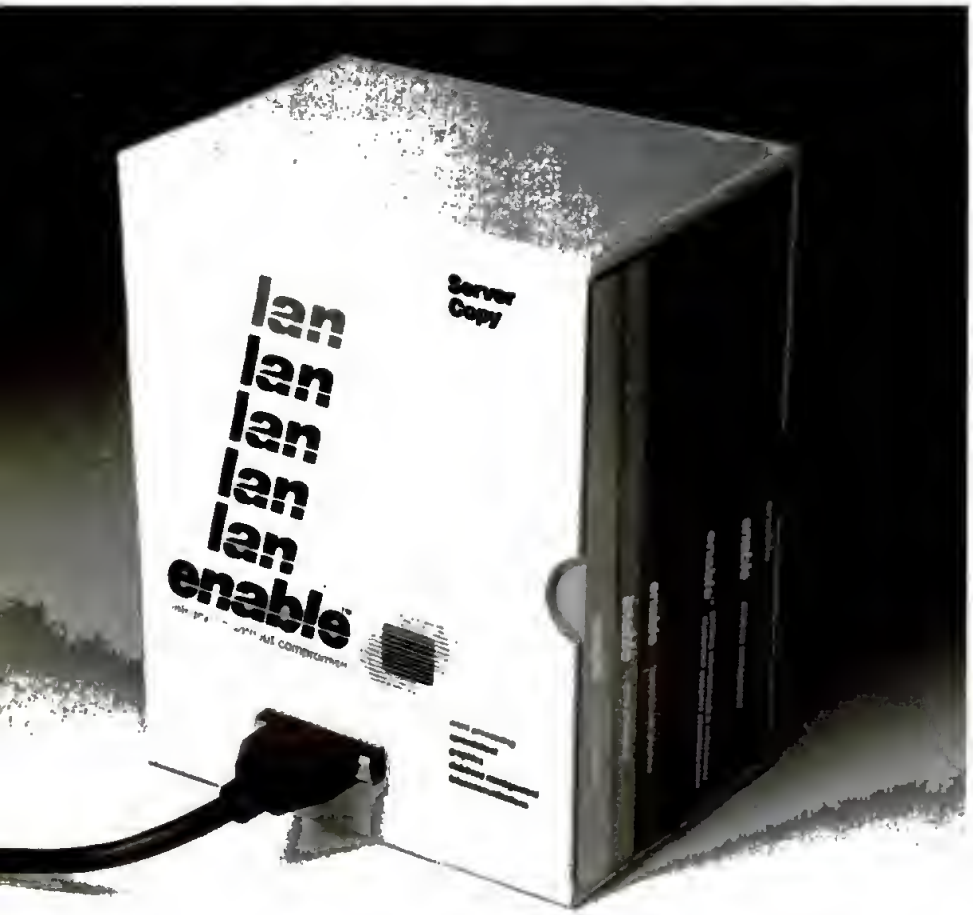
RECORDER.BAS: *A BASIC program that will automatically create RECORDER.COM.*

■ UTILITIES

```
1100 DATA    3,    0,  172,  222,   81,    0,  170,  226,  804
1190 DATA  249,  131,  238,    3,  235,   22,  195,  119, 1222
1200 DATA  242,  172,   10,  192,  116,   23,   60,   46,  861
1210 DATA  137,  247,   86,  191,  163,    1,  185,    3,  993
1220 DATA    0,  172,   10,  192,  116,    6,  232,   46,  774
1230 DATA    0,  170,  226,  245,   94,   78,   78,  253, 1144
1240 DATA  185,    0,    0,  191,  162,    1,   59,  242,  840
1250 DATA  114,   20,  172,   60,   92,  116,   23,   60,  645
1260 DATA   47,  116,   19,   60,   50,  116,   15,   60,  491
3270 DATA   32,  116,    4,  232,    9,    0,  170,  131,  694
3280 DATA  254,  255,  116,    2,  226,  224,  195,   60, 1332
3290 DATA   97,  114,    6,   60,  122,  119,    2,   36,  556
1300 DATA  223,  195,   83,  180,   81,  205,   33,   80, 1080
1310 DATA    2,  216,  195,   30,    7,  191,   94,    5,  741
1320 DATA  139,   14,  186,    1,   51,  192,  171,  131,  805
1330 DATA  199,   30,  171,  131,  199,    6,  226,  246, 1180
1340 DATA  191,  230,    4,  185,   30,    0,   51,  192,  803
1350 DATA  171,  184,   94,    5,  171,  226,  247,   46, 1144
1360 DATA  199,    6,  110,    1,   96,    5,   46,  199,  668
1370 DATA    6,  112,    1,  230,    4,  195,  232,  169,  949
1380 DATA    1,  227,   40,   51,  192,  130,   20,  120,  805
1390 DATA  235,   48,  114,   13,  120,  251,    9,  119,  917
1400 DATA    0,  183,   10,  246,  231,   50,  255,    3,  986
1410 DATA  395,   70,  226,  233,   11,  192,  116,   11, 1054
1420 DATA   61,  200,    7,  110,    2,  184,  200,    7,  796
1430 DATA  163,  186,    1,  184,   19,   53,  205,   33,  764
1440 DATA  137,   30,  182,    1,  140,    6,  184,    1,  521
1450 DATA  186,  173,    1,  184,   19,   37,  205,   33,  838
1460 DATA  184,   33,   53,  205,   33,  137,   30,   90,  773
1470 DATA    1,  140,    6,  180,    3,  186,  193,    1,  628
1480 DATA  184,   33,   37,  205,   33,  232,  115,  255, 1094
1490 DATA  161,   44,    0,  142,  192,  180,   73,  205,  997
1500 DATA   33,  161,  186,    1,  187,   20,    0,  247,  755
1510 DATA  227,    5,   94,    5,  163,  180,    1,    5,  600
1520 DATA   15,    0,  177,    4,  211,  232,  139,  200,  986
1530 DATA  184,    0,   49,  205,   33,  144,  186,    3,  804
1540 DATA    1,  232,   23,    1,  247,   22,    0,    1,  527
1550 DATA   51,  219,  140,  200,   67,   50,  195,  142, 1073

1560 DATA  185,  117,    2,  232,  184,  255,  180,    0, 1807
1570 DATA    1,  139,  256,  185,   16,    0,  243,  166, 1004
1580 DATA   11,  201,  117,  232,    6,   31,  191,   84,  883
1590 DATA    5,  139,   14,  186,    1,  190,   69,   11,  543
1600 DATA    0,  131,  190,   20,  226,  247,  232,  230, 1205
1610 DATA    0,  186,  114,    1,  232,  220,    0,  139,  892
1620 DATA   34,  186,    1,   81,  191,   94,    5,   51,  543
1630 DATA  192,  139,   14,  186,    1,   57,   69,   12,  590
1640 DATA  110,   11,  120,  125,   11,    0,  117,    5,  515
1650 DATA  139,  247,  139,   69,   12,  131,  199,   20,  956
1660 DATA  226,  235,  120,  124,   31,    3,  116,   79,  920
1670 DATA  198,   60,   11,    1,  139,  216,  131,  198,  960
1680 DATA   12,  131,   60,    0,  116,   65,  180,   64,  628
1690 DATA  187,    1,    0,  185,    0,    0,  205,   33,  619
1700 DATA   82,  176,   46,  232,  142,    0,   80,  131,  899
1710 DATA  194,    0,  180,   64,  185,    3,    0,  205,  839
1720 DATA   33,  173,   80,  232,   60,    0,  173,  232,  983
1730 DATA   56,    0,  173,  232,   52,    0,  173,  232,  910
1740 DATA   40,    0,  232,  122,    0,   80,   80,  226,  805
1750 DATA  154,   61,    2,    0,  116,    9,  232,  110,  682
1760 DATA    0,  186,   77,    1,  232,  180,    0,  232,  828
1770 DATA  112,    0,  227,   12,   46,  130,    4,   12,  551
1780 DATA   32,   60,  114,  116,    0,   70,  226,  244,  870
1790 DATA  184,    0,   76,  205,   33,  232,  123,  254, 1107
1800 DATA  235,  246,   80,  176,   32,  232,   60,    0, 1061
1810 DATA  176,   32,  232,   55,    0,   80,   51,  201,  835
1820 DATA  187,   16,   39,  232,   24,    0,  187,  232,  917
1830 DATA    2,  232,   10,    0,  187,  180,    0,  232,  772
1840 DATA   12,    0,  187,   10,    0,  232,    6,    0,  447
1850 DATA    4,   40,  232,   23,    0,  195,   51,  210,  763
1860 DATA  247,  242,   82,   11,  200,   11,  201,  117, 1112
1870 DATA    2,  176,  240,    4,   40,   81,  232,    3,  786
1880 DATA    0,   80,   80,  195,  130,  200,  180,    2,  900
1890 DATA  205,   33,  195,  180,    0,  205,   33,  176, 1036
1900 DATA   13,  232,  240,  255,  176,   10,  232,  235, 1393
1910 DATA  255,  195,  190,  120,    0,   46,  130,   12,  964
3920 DATA   50,  237,   70,  252,  195,    0,    0,    0,  804
```

(RECORDER.BAS ends)



ENABLE LAN.

Put Enable 2.0's LAN version to work and you have the most useful, powerful network software on the market. With Word Processing, Spreadsheet, Graphics, Database Management and Telecommunications rivalling the functionality of the best stand-alones. In an *Infoworld* side-by-side comparison of all integrated LANs, Enable/LAN came out on top "...Easier to learn and use... the best integration... [Enable] simply feels right."

file for reading and writing. Handles make it easy to have many files open at once. DOS maintains a data area for each one, relieving the application program of the task. In addition, DOS provides the following standard handles for input and output to the console.

```
0 - Standard Input
1 - Standard Output
2 - Standard Error
3 - Standard Auxiliary
4 - Standard Printer
```

Since these last don't require disk activity, however, RECORDER ignores them.

UNDERSTANDING RECORDER RECORDER uses two major data structures to keep track of file activity. The file table already mentioned contains the information displayed each time you run the utility. The handle table is used internally to keep track of which handles are in use. First let's look at the file table. It consists of a series of records, one for each file. Each record is 20 bytes long and contains the information as shown in the table "RECORDER Record Format."

■ RECORDER uses two data structures to track file activity: the file table and the handle table.

To ensure that filenames will be matched correctly, they must always be stored in exactly the same format. All characters are converted to uppercase and all embedded spaces are removed. In addition, any names with less than the full eight letters are padded with spaces. The file extension is treated similarly. By following this rule, names such as "Data.Dat" and "DATA .DAT" will be matched.

To facilitate entering new names in the table, a pointer is used to mark the most recent entry. This pointer is advanced to the next record each time a name is added. When the table fills, the pointer is set back to the first entry. Additional entries can then be made by bumping an entry that has a total of only one. When every entry has a total of two or more, the table is considered saturated and no more entries can be made. This algorithm prevents a new file entry from bumping out an older entry that has already accumulated a high total. At the same time, the oldest entries with only one access are the first to go as new files are added.

The second data structure is the handle table. Its purpose is not so obvious. Recall

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■ UTILITIES

that when handles are used to access files, the file's name is specified only when it is created or opened. The handle table provides the logical relationship between handles and filenames.

Each time a new file is encountered, its name is entered into the file table and its corresponding handle is put in the handle table. The handle table contains two words for each entry: the 16-bit handle and a pointer to the matching record in the file table. Whenever a handle is referenced, you simply look it up in the handle table to determine the corresponding filename. You then increment the appropriate columns in the matching record of the file table.

When the file is closed, its entry is deleted from the handle table. Up to 50 handles can be accommodated at any one time, which is more than any program would normally use. A pointer in the handle table is used to mark the latest entry, and entries are made sequentially in a first-in, last-out manner.

This simple scheme has one additional refinement. It would be possible for several programs to execute concurrently. The print command is an example of this. Each program could have handles open with the same 16-bit identifiers but different names, and RECORDER must be able to distinguish between them. To do this, each handle is encoded by adding the current program segment prefix (PSP) to it before it is inserted into the table. The current PSP is obtained by using the undocumented DOS function call 51h. Thus, even in this situation, each handle of each process can be uniquely identified.

SNOOPING AROUND INT 21H Like most resident programs, RECORDER helps itself to the interrupt vector table. An integral part of the Intel family of processors, this important table holds the locations of the most-critical system routines. During RECORDER's installation, the interrupt 21h vector is set to the procedure NEWINT21, which maintains the utility's two internal tables. Each time it is called, it does its own work and then makes a far call to the address that was found in the original interrupt table. This technique ensures that RECORDER remains transparent to the operating system.

The first step in NEWINT21 is checking its busy flag. BUSY_FLAG is set each time a function is intercepted and cleared when it completes. NEWINT21 needs local memory to store function parameters, so it can't handle more than one function at a time. If a recursive call is made, it must be ignored by jumping directly to the original DOS vector. Since most DOS functions are nonreentrant, this bypass is seldom required. Because of this limitation, however, RECORDER may fail to include in its list all the files accessed by such background processes as the PRINT command.

The next step is to weed out irrelevant function calls. Functions numbered below

SHIFTING INTO HIGH GEAR WITH VDISK

If you've never used a RAMdisk, you really ought to give it a try. Everyone with DOS 3.0 or higher already has it available, and most memory expansion boards come packaged with similar software. If you haven't yet expanded to 640K, now may be the time. With the price of RAM lower than ever, buying more is guaranteed to give you a lot of bang for your buck. With a full megabyte you'll be able to allocate 384K for a RAMdisk while maintaining 640K for your DOS applications.

VDISK is a device driver that is loaded when DOS is initially started. It then steals some RAM and configures it like just another drive. To use it, make sure the file VDISK.SYS is on your boot disk. Then you'll need to add a line to your CONFIG.SYS file. If you don't already have this file, you can create it with any ASCII text editor. CONFIG.SYS should be in the root directory of your boot disk. The syntax for VDISK is

```
DEVICE=C:\DOS\VDISK [/E] [n]
```

This example assumes that the VDISK driver is located in the DOS subdirectory. The *n* parameter specifies the size of the disk in kilobytes. If you're using a machine with extended memory installed, the /E parameter will instruct VDISK to utilize it.

The drive letter for your newest disk will be one greater than DOS assigned to your last physical drive. For most users, who have one hard disk, this will be "D:". If you create multiple drives with VDISK, each will automatically use the next available letter. Don't try formatting the virtual disk; DOS does that by itself when installing VDISK. Likewise, don't try to use the DISKCOPY command with VDISK.

How much memory should you allocate to the RAMdrive? Well, everyone's needs are different. RECORDER provides you with a clue as to which files should (if possible) be stored on the RAMdrive, and your job is to save just enough ordinary free memory to run your largest program without losing speed. You could run CHKDSK to show how much you've got left and then dig through your program manuals to determine their requirements. In most cases, however, it's easier just to keep increasing the VDISK size until you get the "Insufficient memory" error when running your largest program. Most users with 640K can spare around 196K. Of course, if you load a lot of other TSRs (print spoolers and disk caches also fall into this category), you may want to use a smaller virtual disk.

Load the new disk by copying your most-used files to it. Putting the necessary COPY commands in your AUTOEXEC.BAT file makes this step painless. Then adjust your path statement so that the RAMdisk is the first drive listed. For example:

```
PATH=D:\;C:\DOS;C:\UTIL
```

This ensures that files copied onto the RAMdisk will be read from there rather than from the slower drive C:.

—Tom Kihlken

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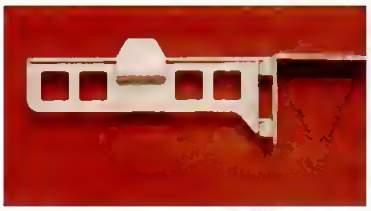
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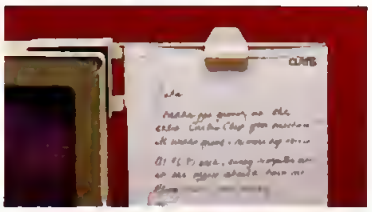
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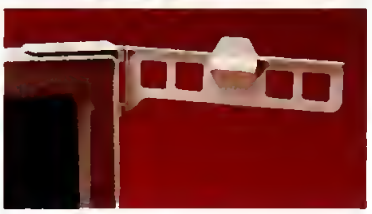




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PC MAGAZINE

HELP FILE

Volume 7
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BASICA 3.*x* Identifiers

IBM BASIC comes in four varieties: Cassette, Disk, Advanced, and Compiler. Cassette BASIC is stored in ROM on the IBM PC. Disk BASIC is the BASIC.COM program that comes with DOS. Advanced BASIC is the BASICA.COM program that also comes with DOS. The BASIC Compiler is a separately purchased program.

This Help File lists standard identifiers for Advanced BASIC 3.*x*. Some of these commands will not work in the other versions of BASIC mentioned above, or in previous versions of Advanced BASIC.

IBM-compatible computers require their own versions of BASIC, e.g., GW-BASIC. Most of the identifiers listed here will also correspond to these other BASIC versions, but some may not.

SYNTAX: BASICA [*filename*] [<*input*] [>|>>*output*][/F:*files*] [/S:*bsize*] [/C:*combuffer*] [/M:[*max workspace*][,*max blocksize*]] [/D]

filename = BASIC program file to load and run
input = file or device for redirected input
output = file or device for redirected output
files = number of files that can be open at once. Default 3. Maximum is number specified in FILES= line of CONFIG.SYS minus 4.
bsize = buffer size for random files. Default 128 bytes. Maximum 32767 bytes.
combuffer = receive buffer size for communications. Default 128 bytes. Maximum 32767 bytes.
max workspace sets space allocated for BASIC data and stack segments. Default 64K.
max blocksize reserves space for assembly routines above highest location BASIC can address (65536).
/D makes double precision math functions resident.

BASIC identifiers are variables, functions, statements, and commands. Variables are available for your examination and use. Functions return a value based on zero or more arguments. Statements and commands both perform an action, but in general you use statements within programs and commands in direct mode.

BASIC Commands

Arguments for BASIC commands:
filename: A valid DOS file name preceded and optionally followed by a quote mark ". No wildcards.
filespec: A valid DOS file specification preceded and optionally followed by a quote mark ". May include wildcard characters.
line: A program line number from 0 to 65535. Can be replaced with a period to represent current line.
offset: An offset from 0 to 65535 in the current segment. Set the current segment with DEF SEG.
path: a string expression defining a valid DOS pathname.

AUTO — Automatic line numbering
SYNTAX: AUTO [*line*] [,[*increment*]]
line = line to start numbering. Default 10. If increment specified, defaults to 0.
increment = increment between numbers. Default 10. If comma included without increment, defaults to previous increment.

BLOAD — Load disk file to memory
SYNTAX: BLOAD *filename*[,*offset*]
offset = default to offset used when file was BSAVEd

BSAVE — Save from memory to disk file
SYNTAX: BSAVE *filename, offset, length*
length = length of memory image to be saved

CHDIR — Change directory
SYNTAX: CHDIR *pathname*

CLEAR — Clear the data space
SYNTAX: CLEAR [,[*n*][,*m*]]
n = maximum bytes for BASIC data segment. Default 65535.
m = stack space for BASIC. Default 512 bytes or 1/8 of available memory, whichever is smaller.

CONT — Continue after a break
SYNTAX: CONT

DELETE — Deletes lines from program
SYNTAX: DELETE [*line1*] [-*line2*], or, DELETE [*line1*-], or, DELETE [-*line2*]
line1 = first line to delete. Default start of program.
line2 = last line to delete. Default end of program.
line1- = delete all from this line to end

EDIT — Display a line for editing
SYNTAX: EDIT *line*

FILES — Display files in a directory
SYNTAX: FILES [*filespec*]
filespec = default "." on current drive/directory

KILL — Delete file
SYNTAX: KILL *filespec*

LIST — List current program
SYNTAX: LIST [*line1*] [-[*line2*]] [,*filename*]
line1 = first line to list. Default start of program.
line2 = last line to list. Default end of program.
filename = file or device for output

LLIST — List current program to printer
SYNTAX: LLIST [*line1*][-[*line2*]]
line1 = first line to list. Default start of program.
line2 = last line to list. Default end of program.

LOAD — Load program file
SYNTAX: LOAD *filename*[,R]
R = run the program immediately after loading. Causes BASIC to leave open any open data files.

MERGE — Merge lines from ASCII program file into current program
SYNTAX: MERGE *filename*

MKDIR — Create a directory
SYNTAX: MKDIR *path*

NAME — Rename a file
SYNTAX: NAME *filename1* AS *filename2*
NOTE: *Filename1* must exist and *filename2* must *not* exist.

NEW — Delete current program and clear all variables
SYNTAX: NEW

RENUM — Renumber program lines
SYNTAX: RENUM [*newline*] [,[*oldline*][,*increment*]]
newline = first line number for new sequence. Default 10.
oldline = line in current program to start renumbering. Default first line.
increment = increment by which new line numbers will increase. Default 10.

—Neil J. Rubenking

This is the first in a series of Help Files about BASIC.

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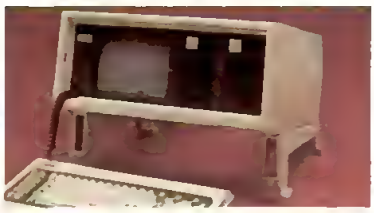
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0Fh and above 44h don't involve files and are always allowed to pass undisturbed. In addition, function 31h (TSR) is not intercepted. Another special case is function 4Bh (EXEC), and it's worth explaining how it works.

Each time you run a .COM or an .EXE program, the EXEC function call is used to load the program into memory and begin its execution. Before this is allowed to happen, RECORDER notes the file's name. This is easily located since the protocol for EXEC specifies that the DS:DX register pair points to it. The procedure ENTER_FILENAME parses the name and searches the file table for it.

The EXEC and total columns of the file table must then be incremented. The base plus displacement addressing mode is used to find these words. The base address for the record is returned by ENTER_FILENAME in register SI. The appropriate displacements are 12 for the total and 18 for the EXEC column. After incrementing these two words, the EXEC function is allowed to proceed. The busy flag is cleared and a far jump is made to the original DOS interrupt vector.

If by chance the table has reached saturation, ENTER_FILENAME returns with the carry flag set to indicate the error. When this happens the increment instructions are skipped and the function is simply allowed to proceed.

The busy flag is set and register AX is stored when file functions are performed. AX contains the function code that we'll need later. Next, we make a far call to DOS to process the request. When DOS finishes its job, we first examine the carry flag to determine whether the function completed sucessfully. If an error occurred, DOS returns with CF=1. Since there is no point in recording errors, we restore the stack and just return. Otherwise, a series of conditional jumps is used to sort out the various functions.

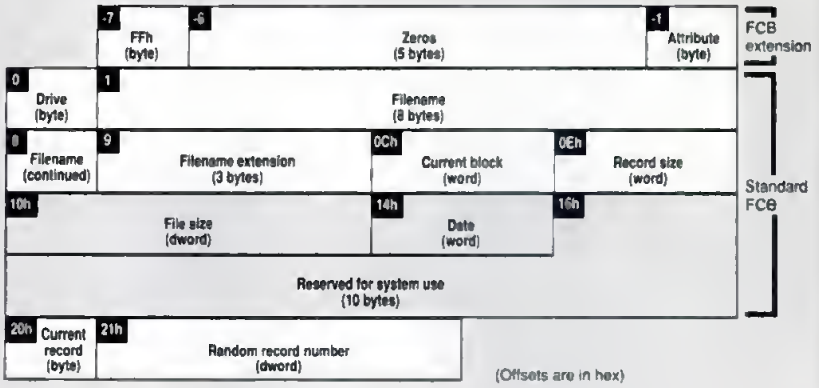
Functions of the FCB variety are categorized at this time as either a read or a write. As far as we're concerned, the only difference among FCB functions is which columns of the file table will be affected. Register BX is set to the appropriate displacement of the column to be modified. With these FCB functions, DS:DX points to a control block containing the file name. Again ENTER_FILENAME is called to locate this name in the file table (or, if necessary, to add it).

The number of disk operations can then be added to the correct columns. Remember, we put the column displacement in BX (either 14 or 16). The offset of the correct file table record is now in register SI. These base and index registers are combined to form the effective address for the appropriate column. Naturally, the totals column must also be increased by the same amount. To access this column, a displacement of 12 is used. Lastly, all registers that were modified are restored, and a far return instruction passes control to the requesting program.

Things get a little more difficult when the handle functions are used. These functions are divided into three classes: those that read, those that write, and those that require a new entry in the handle table. Reads and writes are processed similarly to the FCB functions. The main difference here is simply how the correct record of the file table is located.

Each time a file is opened or created, it must be added not only to the file table but to the handle table as well. To do this, the name is obtained from the DS:DX pointer. A search is made of the file table to determine whether the name is already there. If not, it is entered and the four corresponding columns (totals, reads, writes, and EXECs) are zeroed out. Next, a new entry is made in the handle table. This handle ta-

File Control Block Fields



The layout of the FCB showing the size and placement of the file information maintained by DOS.

DOS File Functions

Functions for file control blocks

Function	Purpose
0Fh	Open file
10h	Close file
14h	Sequential read
15h	Sequential write
16h	Create file
21h	Random read
22h	Random write
27h	Random block read
28h	Random block write

Functions for file handles

Function	Purpose
3Ch	Create file
3Dh	Open file
3Eh	Close file
3Fh	Read file
40h	Write file
42h	Move pointer
44h	I/O control

These DOS file functions are counted by RECORDER to determine the extent of file activity.

ble entry will provide the relationship between the handle and file table record. Before entering the new handle, however, it is first encoded by adding the PSP of the calling program. With the new table entries made, the number of disk interrupts is added to the read and total columns.

When RECORDER is reading or writing from a file, only the handle is specified. The handle table must be consulted to determine the file's name. As mentioned earlier, the caller's PSP is obtained and added to the handle. Then the handle table is searched for this entry. When a match is found, the corresponding file table entry can be retrieved. From here on, it's treated the same as an FCB function. Handles with numbers lower than five (the "standard" handles) are not considered.

When a handle is closed, it is treated like a write, with one exception. The handle table entry is zeroed to prevent it from incorrectly matching a later read or write.

PARSING FILENAMES I've mentioned the procedure ENTER_FILENAME several times. Its job is to search the file table for the filename being used by the current function. The current file is passed to it by the DS:DX register pair. On return, it sets register SI to the matching entry in the file table. When ENTER_FILENAME encounters a new file (one not yet in the table), it attempts to add it. Should the table be full, the procedure returns with the carry flag set to indicate the full condition.

The interesting thing about this routine is that it can work with either FCBs or with the newer handle type of function. While the basic principles are the same, FCBs pass the name differently than do the handle functions. To handle the difference, there are two parsing routines. FCBs use the routine PARSE_FCB, while handles use PARSE_STRING. How does ENTER_FILENAME know which one to use? The answer is easy: the address of the correct one is passed to it in register SI.

These two parsing routines transfer the name into a temporary holding area in which any missing letters are replaced with spaces and all letters are converted to uppercase. At the same time, any drive and path information that may have been included is stripped off.

The current file is then compared against each entry in the table. The string compare instruction, with a repeat count of 11, makes this quick and easy. If a match is found, the appropriate location is returned. Otherwise, the table is again searched for an empty slot.

This time the search is begun with the last filename entered. We'll be looking for an entry with a value of one or less in the totals column. If there aren't any left, we mark the table as saturated and return with the carry flag set. If space is available, the new name is copied from its temporary holding area to the table. The four columns (total, read, write, EXEC) are then set to zero. Lastly, the pointer to the last file entered is set to this location.

COUNTING SECTORS Not all read and write requests require accessing the disk. DOS maintains internal buffers that hold the sectors most recently used, and many small I/O requests can be handled by the buffers alone. This buffered I/O is lightning fast compared to the time required for the drive head to reach the correct sectors. RECORDER is intended to reflect only the time required for disk operation. To accurately meter this, a count of the number of disk interrupts is maintained. A function may require zero, one, or many disk operations depending on the amount of data being transferred. After each function, the count is added to the appropriate columns of the file table.

The counter intercepts the BIOS disk interrupt. Whenever DOS needs to do physical I/O, it delegates that task to the basic input/output system, which is located in read-only memory (ROM-BIOS). The disk interface is provided by interrupt 13h. RECORDER steals this vector and points it to the procedure NEWINT13. Thus, when a disk is accessed, the counter BIOS_IO_COUNT is incremented. Each interrupt can handle anywhere from one sector to an entire track. Interrupt 13h provides functions other than reading and writing. Two of the other functions (formatting a track and resetting the controller) are never counted. The final function is used to verify the integrity of the disk data. If you've set VERIFY=ON, this process will require additional disk accesses, which RECORDER faithfully counts.

■ Not all read and write requests require accessing the disk. Many can be handled by DOS's buffers.

Since only devices that use interrupt 13h will affect the counter, some storage devices are neglected. For example, the Bernoulli box uses its own device driver instead of interrupt 13h. Similarly, most RAMdisk software doesn't issue interrupt 13h, so virtual disks are also ignored.

The information gathered by RECORDER would be useless if you couldn't see it. Converting binary encoded data to a readable format is so common, most people take it for granted. But it doesn't happen by itself. It involves finding the table, sorting it, and displaying the names with the sector information.

Each time RECORDER is run from the command line, it first searches through the computer's memory for the program's copyright notice (a hoary technique, but effective). If it's not present, then the pro-

RECORDER Record Format

Byte	Function
0–7	Filename (right justified and padded with blanks)
8–10	Extension (left justified and padded with blanks)
11	Byte, used for sorting the table
12–13	Word, integer for total column
14–15	Word, integer for read column
16–17	Word, integer for write column
18–19	Word, integer for EXEC column

RECORDER stores the information needed to track each file in a 20-byte field arranged as shown.

RECORDER BY MODEM

The programs published in *PC Magazine* can be downloaded by modem from the PC Magazine Interactive Reader Service. There is no charge for this service, but users are cautioned that these programs are copyright material and are made available only for individual, noncommercial use. You may make copies for others (including placement on noncommercial electronic bulletin boards), as long as no charge is involved. Making copies for any commercial purpose, however, is strictly prohibited.

The Eastern modem number for PC-IRS is (212) 696-0360. In the West, call (415) 598-9100. Set your modem and communications software to use 2400/1200/300 bps, 8 data bits, 1 stop bit, no parity. Files with a .COM, .EXE, or .ARC extension require use of the Xmodem error-checking protocol; files with .ASM or .BAS extensions can be downloaded using either regular ASCII or Xmodem.

If you use Xmodem, you can download RECORDER.COM directly, saving typing or downloading either the .BAS or the .ASM version. RECORDER.BAS, whether entered at your keyboard or downloaded from PC-IRS, will automatically create RECORDER.COM when run once in BASIC. RECORDER.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM RECORDER;
LINK RECORDER;
EXE2BIN RECORDER RECORDER.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.

RECORDER Command

Tom Kihlken 1988/ No. 9 (Utilities)

Purpose: Keeps a log of the number of times each file is accessed over a period of time to show which files would benefit from being stored on a RAMdisk.

Format: `RECORDER [n] [/R]`

Remarks: RECORDER is a memory-resident utility that should normally be loaded by being included as a line in an AUTOEXEC.BAT file. By default it will keep track of disk I/O activity (reads, writes, EXECs) for 200 filenames. The optional *n* parameter can be entered at the time the utility is loaded to increase the number of filenames to 2,000. Each additional filename requires 20 bytes of RAM.

The current log can be seen by entering RECORDER at the DOS prompt. Entering RECORDER with the /R switch resets the table; this may be done at any time, and certainly if the error message "Table is saturated" is displayed.

Redirection is supported so the results can be stored to a file.

Example: At the end of a morning's use, for example, to store the results and reset the table simultaneously, enter

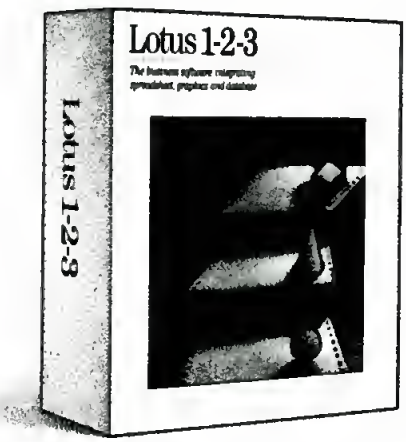
```
RECORDER /R > FILES.LOG
```

By default, RECORDER sorts by the numbers in the totals column. The DOS SORT program can be used to sort by the values in other columns. The read column begins with character 20, the write column with 27, and the EXEC column with 34.

Example: To sort the table by the number of entries in the EXEC category, enter

```
RECORDER | SORT /+34
```

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■ UTILITIES

gram hasn't been loaded yet. In this case the initialization routine takes over and no display is needed. If the copyright notice is found, then the program is already installed, and the existing table is retrieved and displayed.

The usual method of sorting a table involves rearranging the entries from highest to lowest. But sorting the file table is different. The order of the entries must not be changed, since they are to be kept in a chronological order. Instead, a search is made for the entry with the highest total and that file is displayed. This entry is then marked as completed and the next highest total is sought. This loop is completed until all entries get written out. If you're wondering how files are marked as complete, the answer lies in the 11th byte of the table entry. This byte is initially cleared. As each file is displayed the byte is set to one, indicating the file should be excluded from subsequent searches.

Copying the filename to the screen is fairly straightforward. Notice that I've used DOS output services, so redirection of output will work. Although DOS output is somewhat slower than more direct methods, its versatility makes it worth the wait in this case. Converting the numbers for each column to character data is done by the procedure NUMBER_OUT. It first outputs two spaces to separate the columns. Next, the simple algorithm of dividing by 10,000, 1,000, 100, etc., is used to isolate each digit. The result of each division is converted to ASCII by adding 30h. The character is then displayed to the standard output device. Leading zeros are suppressed by using register CX to indicate when the first nonzero digit is encountered. As long as CX is zero, any zero digits are displayed as spaces.

RECORDER by itself can't do much for your system. But teamed with RAM-disk software, a disk organizer, and your careful scrutiny, it can squeeze that extra ounce of performance from your system. And what can be more cost effective than making the most of your existing equipment? You'll also get the satisfaction of knowing your hardware is being used to its full potential. PC

Tom Kihlken is an occasional contributor to PC Magazine.

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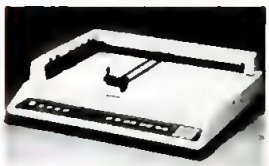
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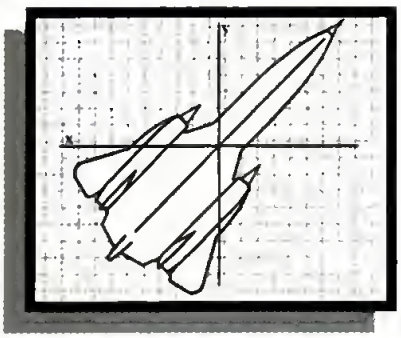
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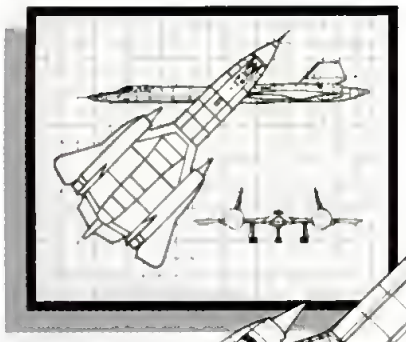
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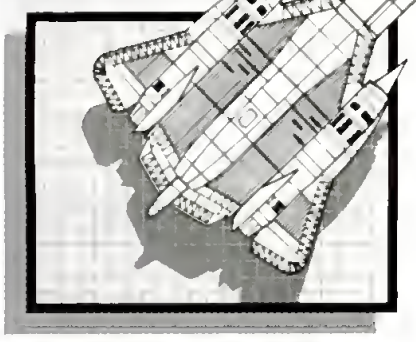
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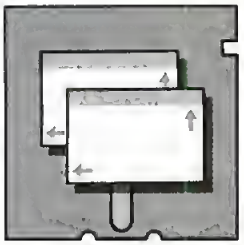
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■ ENVIRONMENTS ■ CHARLES PETZOLD

EXPLORING THE OS/2 .EXE FILE



The old DOS .COM and .EXE file formats are unsuitable for protected-mode operation under OS/2. Here's the lowdown on the OS/2 "New Executable" file format.

DOS supports two binary file formats for executable files: .COM and .EXE. The .COM format was inherited from CP/M. The format is adequate for a program up to 64K in length that does not require relocation information for adjusting explicit references to segment addresses within the program. DOS loads a .COM file into memory at offset 100h in a segment and sets all four segment registers to the same segment address. Many small assembly language programs (such as those that appear regularly in the Productivity section of *PC Magazine*) use the .COM file format because it is compact and simple.

The .EXE format was designed specifically for DOS. It supports programs over 64K in length and those that make references to explicit segment addresses. A relocation table in the header section of the .EXE file allows DOS to adjust these references based on where the program is loaded into memory.

NOT ADEQUATE FOR OS/2 Neither the .COM format nor the .EXE format is suitable for a protected-mode operating system such as OS/2. The .COM format is clearly inadequate because code and data share the same segment. Under OS/2, code and data must be located in separate segments.

The .EXE format is also inadequate because there is no information in the file that defines how the binary image of the executable breaks down into code and data segments. Although .EXE format programs often use separate segments for code and data, the operating system cannot determine where these segments begin and end in the file.

For this reason, a new format for executable files was required for OS/2. It's called (appropriately enough) the "New Executable" format, or sometimes the "Segmented Executable" format. The latter name indicates that the various code and data segments that make up the program are identified in the file.

Actually, the New Executable file format isn't all that new. It was first used with *Microsoft Windows*, which was introduced in November 1985. The format is documented in the *Windows 2.0* Development Kit, in Appendix K of the all-new *MS-DOS Encyclopedia* (Microsoft Press, 1988), and in Microsoft's mammoth $3,000 OS/2 Software Development Kit.

New Executable files have an .EXE extension because they incorporate the old MS-DOS executable format within the new format. Under OS/2, the New Executable format is used for all programs that run under protected mode (these files can have an .EXE or a .COM extension), all dynamic link libraries (which have the extension .DLL), and all protected-mode device drivers (.SYS extension).

■ The New Executable file format isn't that new. It was first used with *Microsoft Windows*, which was introduced in November 1985.

Although you don't need to understand its format to program in OS/2, examining a typical New Executable file provides some valuable insights into the workings of OS/2. So let's use a hex dump program on an OS/2 .EXE file and take a look. Since you probably don't yet have an OS/2 hex dump program, let's solve that problem right away.

AN OS/2 HEX DUMP Figure 1 shows an OS/2 assembly language program called DUMP.ASM, which is a simple hex dump program. You can assemble this program using Microsoft's MASM 5.0 under the OS/2 DOS compatibility mode simply by entering

```
MASM DUMP;
```

(You could also assemble it with an OS/2 version of MASM, of course.) Then, using the LINK.EXE program included with IBM's OS/2 1.0, run

```
LINK DUMP, /ALIGN:16,, DOSCALLS;
```

The DOSCALLS.LIB file is also included with OS/2 1.0. Before you run LINK, use the SET command to set the LIB environment variable to the directory where you store DOSCALLS.LIB.

```
SET LIB=directory
```

If you don't have the Microsoft Macro Assembler 5.0, you can create DUMP.EXE by typing the BASIC program shown in Figure 2 into BASICA and running it. This will automatically create DUMP.EXE for you.

DUMPING DUMP.EXE You can use DUMP to dump itself by typing

```
DUMP DUMP.EXE
```

Figure 3 shows what you'll see, and it identifies the five major sections of the file. (If you created DUMP.EXE from the BASIC program, you'll see two more bytes at the end of the file.)

DUMP is a "small model" program—that is, it has one code segment and one data segment. Medium model programs have multiple code segments; compact model programs have multiple data segments; and large model programs have multiple code and data segments. *Windows* programs and OS/2 Presentation Manager programs have additional segments following the code and data segments: these additional segments are for "resources," which include icons, cursors, and bitmaps, and templates for menus and dialog boxes.

You'll notice that the code and data segments begin on a nice even 16-byte boundary. That's the result of using the /ALIGN:16 switch when running LINK.

A TALE OF TWO HEADERS An OS/2 .EXE file has two header sections. The first is the familiar DOS .EXE header; the second is the New Executable header. Each header begins with a 2-byte "signature" word. The DOS signature word is "MZ," the initials of Mark Zbikowski, one of the key designers of DOS at Microsoft. The more anonymous "NE" signature that begins the New Executable header stands for "New Executable."

When you run DUMP.EXE under DOS or under the OS/2 DOS compatibility mode, the operating system recognizes the DOS .EXE header and assumes the file is a normal DOS executable. It therefore runs the DOS program that is embedded in the file. The program simply displays the message, "This program cannot be run in DOS mode," and terminates.

■ An OS/2 .EXE file has two header sections. The first is the DOS .EXE header; the second is the New Executable header. Each begins with a 2-byte "signature" word.

This tiny DOS program is automatically inserted into the .EXE file by LINK. (Earlier versions of LINK distributed with the Microsoft OS/2 Software Development Kit did not do this.) It is also possible to specify a different program to be inserted into the OS/2 .EXE file by indicating its name in a "module definition file" and specifying the module definition file as the fifth parameter to LINK.

When you create a "dual-mode" (or Family API) program that runs under both OS/2 and DOS, the tiny DOS program is replaced with a much larger DOS loader program. This loader program patches the OS/2 program so that the calls it makes to OS/2 functions are replaced with calls to DOS functions that approximate the OS/2 functions.

When you execute a dual-mode .EXE file under OS/2, OS/2 looks at the double word stored at offset 3Ch in the DOS header section (see Figure 4). This double word is the offset in the .EXE file where the new header section begins. In the discussion below, I'll refer to this offset as NEWHDR ("new header").

IDENTIFYING THE SEGMENTS When OS/2 loads a program into memory to be executed, it must be able to identify the code and data segments in that program. OS/2 can then allocate segments for the program and set up the program's "local descriptor table," which is required in protected mode.

The header section contains a "segment table" that identifies all the code and data segments in the program. Figure 5 shows the New Executable header and the information that OS/2 employs in order to

```
;-------------------------------------------------------
; DUMP.ASM -- OS/2 Hex Dump Program
;             (C) 1988, Ziff-Davis Communications Co.
;             Programmed by Charles Petzold, 12/87
;-------------------------------------------------------

                EXTRN   DosOpen:FAR,  DosRead:FAR, DosWrite:FAR
                EXTRN   DosClose:FAR, DosExit:FAR

                DOSSEG
                .286
                .MODEL SMALL
                .STACK 200h
                                        ;---------------------------
                .DATA                   ; Initialized Data Segment.
                                        ;---------------------------

SyntaxMsg       db   13, 10,     "Syntax: DUMP filename"
                db   13, 10, 10, "(C) 1988, Ziff-Davis Communications Co."
                db   13, 10,     "Programmed by Charles Petzold, 12/87"
                db   13, 10
SyntaxMsgLen    equ  $ - SyntaxMsg

FileSpecMsg     db   "DUMP: File not found or cannot be opened"
FileSpecMsgLen equ  $ - FileSpecMsg

Delimiters      db   9, " ,;=", 0

Address         dw   0, 0
                                        ;-----------------------------
                .DATA?                  ; Uninitialized Data Segment
                                        ;-----------------------------

FileHandle      dw   ?
OpenAction      dw   ?
BytesRead       dw   ?
BytesWritten    dw   ?
InputBuffer     db   16 dup (?)
OutputBuffer    db   80 dup (?)
                                        ;--------------
                .CODE                   ; Code Segment
                                        ;--------------

;-----------------------------------------------
; Parse command line to get file specification
;-----------------------------------------------

Entry:          Push DS                         ; Data segment selector
                Pop  ES                         ; Transfer it to ES
                Mov  DS, AX                     ; DS = Environment selector
                Mov  SI, BX                     ; SI = Start of command line

SkipProgName:   Lodsb                           ; Fell a command line byte
                Or   AL, AL                     ; Check if it's zero
                Jnz  SkipProgName               ; If not, continue
```

(continues)

Figure 1: *DUMP.ASM is an OS/2 hex dump program.*

```
SkipDelims:     Lodsb                           ; Get byte from parameter
                Or   AL, AL                     ; Check if it's zero
                Jz   DisplaySyntax              ; If so, exit with message
                Mov  DI, Offset Delimiters      ; Check if delimiter
                Mov  CX, 5                      ; There are 5 of them
                Repne Scasb                     ; Scan the string
                Jz   SkipDelims                 ; If delimiter, loop back

                Mov  DX, SI                     ; Pointer to file name + 1
                Dec  DX                         ; Pointer to file name

SearchFileEnd:  Lodsb                           ; Get a byte
                Mov  DI, Offset Delimiters      ; Check if delimiter
                Mov  CX, 6                      ; 6 of them now including ?
                Repne Scasb                     ; Scan the string
                Jnz  SearchFileEnd              ; If not delimiter, get next byte

                Mov  Byte Ptr [SI - 1], 0       ; Terminate with zero byte
                Jmp  Short OpenFile

;------------
; Print Exit
;------------

DisplaySyntax:  Push ES                         ; Otherwise, set DS to
                Pop  DS                         ;   data segment
                Mov  DX, Offset SyntaxMsg       ; Syntax message offset
                Mov  CX, SyntaxMsgLen           ; Syntax message length

PrintExit:      Push 2                          ; Standard error handle
                Push DS                         ; Segment of string
                Push DX                         ; Offset of string
                Push CX                         ; Length of string
                Push DS                         ; Segment for bytes written
                Push Offset BytesWritten        ; Offset for bytes written
                Call DosWrite                   ; Display the message

                Push 1                          ; Terminate all threads
                Push 1                          ; Return code
                Call DosExit                    ; Exit

;-------------------------
; Open file using Fopen
;-------------------------

OpenFile:       Push DS                         ; Exchange DS and ES
                Push ES
                Pop  DS
                Pop  ES

                Push ES                         ; Segment of file name
                Push DX                         ; Offset of file name
                Push DS                         ; Segment for file handle
                Push Offset FileHandle          ; Offset for file handle
                Push DS                         ; Segment for action
                Push Offset OpenAction          ; Offset for action
                Push 0                          ; High size (not used)
                Push 0                          ; Low size (not used)
                Push 0                          ; Attribute (not used)
                Push 1                          ; Open flag : put if file exists
                Push 20h                        ; Open mode (read, deny write)
                Push 0                          ; Reserved
                Push 0                          ; Reserved
                Call DosOpen                    ; Open the file

                Or   AX, AX                     ; Check for error
                Js   ReadAndDump                ; If none, continue

                Mov  DX, Offset FileSpecMsg     ; Error message
                Mov  CX, FileSpecMsgLen         ; Length of message

                Jmp  ErrorExit                  ; Print it and exit

;-----------------------------------------
; Read 16 bytes from file and display address
;-----------------------------------------

ReadAndDump:    Push DS                         ; Set ES to DS
                Pop  ES

MainLoop:       Push [FileHandle]               ; File Handle
                Push DS                         ; Segment of buffer
                Push Offset InputBuffer         ; Offset of buffer
                Push 16                         ; Length of buffer
                Push DS                         ; Segment for bytes read
                Push Offset BytesRead           ; Offset for bytes read
                Call DosRead                    ; Read the file

                Cmp  [BytesRead], 0             ; See if no bytes read
                Jns  DoLine                     ; If bytes read, continue

                Jmp  AllDone                    ; If zero bytes read, end program

DoLine:         Mov  DI, Offset OutputBuffer    ; Destination

                Mov  AX, [Address + 2]          ; High address within file
                Call HexWordOut                 ; Display the value
                Mov  AL, '-'                    ; A dash
                Stosb
                Mov  AX, [Address]              ; Low offset within file
                Call HexWordOut                 ; Display it

                Mov  AL, ' '                    ; Follow it with a blank
                Stosb

;-------------------
; Prepare Hex Display
;-------------------

                Mov  SI, Offset InputBuffer     ; Source
                Mov  CX, [BytesRead]            ; Number of bytes read
                Sub  BX, BX                     ; Initialize counter

NextByte:       Mov  AL, ' '                    ; A blank normally precedes
                Cmp  BX, 8                      ; Must check if between 8 and 9
                Jnz  DoTheByte                  ; If not, a blank is OK
                Mov  AL, '-'                    ; Otherwise, use a dash
DoTheByte:      Stosb                           ; Display it

                Lodsb                           ; Get a byte
                Call HexByteOut                 ; Convert it to hex

                Inc  BX                         ; Kick up the counter
                Loop NextLoop                   ; And loop for next byte

                Mov  CX, 16                     ; If possible, byte
                Sub  CX, BX                     ; Subtract those already done
                IMul CX, 3                      ; Multiply by 3
                Add  CX, 2                      ; And add 2 for the end
                Mov  AL, ' '                    ; This is all blank
                Rep  Stosb                      ; Store the blanks

;----------------------------
; Prepare Character Display
;----------------------------

                Mov  SI, Offset InputBuffer     ; Source
                Mov  CX, [BytesRead]            ; Number of bytes

CharLoop:       Lodsb                           ; Get the character
                Cmp  AL, ' '                    ; See if displayable ASCII
                Jb   DisplayPeriod              ; If below space, use dot

                Cmp  AL, 7Fh                    ; If DEL or above, use dot
                Jb   DisplayChar

DisplayPeriod:  Mov  AL, '.'                    ; Display period

DisplayChar:    Stosb                           ; Display character
                Loop CharLoop                   ; Do next character

                Mov  AL, 13                     ; Carriage return
                Stosb
                Mov  AL, 10                     ; And line feed
                Stosb

;-----------------------------
; Display line using DosWrite
;-----------------------------

                Sub  DI, Offset OutputBuffer    ; Length of output line

                Push 1                          ; File Handle: Standard output
                Push DS                         ; Segment of buffer
                Push Offset OutputBuffer        ; Offset of buffer
                Push DI                         ; Length of buffer
                Push DS                         ; Segment for bytes written
                Push Offset BytesWritten        ; Offset for bytes written
                Call DosWrite                   ; Display it

                Add  [Address], 16              ; Kick up address
                Adc  [Address + 2], 0
                Jmp  MainLoop                   ; Do another line

AllDone:        Push [FileHandle]               ; File handle
                Call DosClose                   ; Close the file

                Push 1                          ; Exit program
                Push 0
                Call DosExit

;---------------------------------
; Subroutines to store line output
;---------------------------------

HexWordOut:     Xchg AL, AH
                Call HexByteOut                 ; Do high byte first
                Xchg AL, AH
                                                ; Fall through
HexByteOut:     Push AX
                Shr  AL, 4
                Call HexDigitOut                ; Do high digit first
                Pop  AH
                And  AL, 0Fh
                                                ; Fall through
HexDigitOut:    Add  AL, 90h
                Das                             ; Common trick to convert
                Adc  AL, 40h                    ;   hex digit to ASCII
                Das

                Stosb                           ; Store in line buffer
                Ret

                END  Entry
```

(Figure 1 ends)

locate and use this segment table.

The word at (NEWHDR + 1Ch)—which is the word at offset 9Ch in DUMP.EXE—is the number of code and data segments in the file. This is simply 2.

The word stored at offset (NEWHDR + 22h)—which is offset A2h in the DUMP.EXE file—is 0040h. This indicates that the segment table begins at offset (NEWHDR + 40h) or C0h.

The word at (NEWHDR + 32h)—offset B2h in DUMP.EXE—is the "alignment shift count," which is set to 4. (Recall that when linking we specified an ALIGN value of 16, which is 1 shifted left by 4 bits.)

Each segment requires four words (8 bytes) in the segment table. These four words are shown in the table "DUMP.EXE's Segment Table."

■ In the Flags word in the segment table, the least significant bit (bit 0) is 0 for a code segment and 1 for a data segment.

The word in the segment table that indicates the location of the segment in the file must be adjusted. You take the number in the table (0010h or 0028h) and shift it left by the alignment shift count. Thus, segment 1 begins at offset 0100h from the beginning of the .EXE file, and segment 2 begins at offset 0280h from the beginning of the file, which agrees with what was shown in Figure 3.

The Flags word in the segment table describes the segment. The least significant bit (bit 0) is 0 for a code segment and 1 for a data segment. Therefore, in this case, segment 1 is a code segment and segment 2 is a data segment. Bits 10 and 11 indicate the I/O privilege level of the segment. Both these segments run under ring 3, which under protected mode is the least privileged level. This is the normal proce-

```
100 REM -- BASIC PROGRAM TO CREATE DUMP.EXE
110 OPEN "DUMP.EXE" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I% = 1 TO 99
150    LINESUM% = 0
160    FOR J% = 1 TO 8
170       READ BYTE%
180       CHECKSUM = CHECKSUM + BYTE%
190       LINESUM% = LINESUM% + BYTE%
200       LSET A$ = CHR$(BYTE%)
210       PUT #1
220    NEXT J%
230    READ LINECHECK%
240    IF LINECHECK% <> LINESUM% THEN PRINT "Error in Line"; 200 + 10 * I%
250 NEXT I%
260 CLOSE
270 IF CHECKSUM = 53029 THEN PRINT "Successful Completion!" : END
280 PRINT "EXE file is not valid!" : END
290 DATA    77,   90,   22,    1,    2,    0,    0,    0,  192
300 DATA     4,    0,    0,    0,  255,  255,    0,    0,  514
310 DATA   184,    0,    0,    0,    0,    0,    0,    0,  184
320 DATA    64,    0,    0,    0,    0,    0,    0,    0,   64
330 DATA     0,    0,    0,    0,    0,    0,    0,    0,    0
340 DATA     0,    0,    0,    0,    0,    0,    0,    0,    0
350 DATA     0,    0,    0,    0,    0,    0,    0,    0,    0
360 DATA     0,    0,    0,    0,  128,    0,    0,    0,  128
370 DATA    14,   31,  186,   14,    0,  180,    9,  205,  639
380 DATA    33,  184,    1,   76,  205,   33,  84,  104,  720
390 DATA   105,  115,   32,  112,  114,  111,  103,  114,  806
400 DATA    97,  109,   32,   99,   97,  110,  110,  111,  765
410 DATA   116,   32,   98,  101,   32,  114,  117,  110,  720
420 DATA    32,  105,  110,   32,   68,   79,   83,   32,  541
430 DATA   109,  111,  100,  101,   46,   13,   10,   36,  526
440 DATA     0,    0,    0,    0,    0,    0,    0,    0,    0
450 DATA    78,   69,    5,    0,  100,    0,    2,    0,  254
460 DATA    41,    9,   32,  161,    2,    0,    2,    0,  247
470 DATA     0,    0,    0,    0,   16,    0,    1,    0,   17
480 DATA    16,    3,    2,    0,    2,    0,    1,    0,   24
490 DATA    12,    0,   64,    0,   88,    0,   80,    0,  236
500 DATA    88,    0,   90,    0,  230,    0,    0,    0,  400
510 DATA     0,    0,    4,    0,    0,    0,    0,    0,    4
520 DATA     0,    0,    0,    0,    0,    0,    0,    0,    0
530 DATA    16,    0,   78,    1,    0,   13,   78,    1,  167
540 DATA    48,    0,  150,    0,    1,   12,   16,    3,  222
550 DATA     4,   60,   85,   77,   88,    0,    0,    0,  314
560 DATA     1,    0,    0,    0,   60,   79,   83,   67,  386
570 DATA    65,   76,   76,   83,    0,    0,    0,   60,  376
580 DATA    85,   77,   88,   46,   69,   88,   69,    0,  514
590 DATA     0,    0,    0,    0,    0,    0,    0,    0,    0
600 DATA     0,    0,    0,    0,    0,    0,    0,    0,    0
610 DATA     0,    0,    0,    0,    0,    0,    0,    0,    0
620 DATA     0,    0,    0,    0,    0,    0,    0,    0,    0
630 DATA    30,    7,  142,  216,  139,  243,  172,   10,  959
640 DATA   192,  117,  251,  172,   10,  192,  116,   30, 1088
650 DATA   191,  145,    0,  105,    5,    0,  242,  174,  942
660 DATA   116,  241,  139,  214,   74,  172,  191,  145, 1292
670 DATA     0,  105,    6,    0,  242,  174,  117,  245,  969
680 DATA   198,   60,  255,    0,  235,   31,    6,   31,  824
690 DATA   186,    0,    0,  105,  105,    0,  186,    2,  584
700 DATA    30,   82,   81,   30,  104,  162,    0,  154,  643
710 DATA   255,  255,    0,    0,  186,    1,  186,    1,  724
720 DATA   154,  255,  255,    0,    0,   30,    6,   31,  731
730 DATA     7,    6,   82,   30,  104,  156,    0,   30,  415
740 DATA   184,  158,    0,  186,    0,  186,    0,  186,  580
750 DATA     0,  186,    1,  186,   32,  186,    0,  186,  457
760 DATA     0,  154,  255,  255,    0,    0,   11,  192,  867
770 DATA   116,    0,  186,  185,    0,  185,   48,    0,  648
780 DATA   235,  188,   30,    7,  255,   54,  156,    0,  925
790 DATA    30,  184,  164,    0,  186,   16,   30,  184,  554
800 DATA   160,    0,  154,  255,  255,    0,    0,  131,  955
810 DATA    62,  160,    0,    0,  117,    3,  235,  123,  788
820 DATA   144,  191,  188,    0,  161,  153,    0,  232, 1061
830 DATA   131,    0,  176,   45,  178,  161,  151,    0,  834
840 DATA   232,  122,    0,  176,   32,  178,  198,  164, 1086
850 DATA     0,  139,   14,  160,    0,   43,  219,  176,  751
860 DATA    32,  131,  251,    0,  117,    2,  176,   45,  762
870 DATA   178,  172,  232,  183,    0,   67,  226,  239, 1209
880 DATA   185,   16,    0,   43,  203,  187,  201,    3,  758
890 DATA   131,  193,    2,  176,   32,  243,  178,  198, 1137
900 DATA   164,    0,  139,   14,  160,    0,  172,   68,  789
910 DATA    32,  114,    4,   68,  127,  114,    2,  176,  629
920 DATA    46,  178,  226,  242,  176,   13,  178,  176, 1219
930 DATA    18,  178,  129,  239,  188,    0,  186,    1,  835
940 DATA    30,  184,  188,    0,   87,   30,  184,  162,  697
950 DATA     0,  154,   88,    0,    0,    0,  131,    6,  371
960 DATA   151,    0,   16,  131,   22,  153,    0,    0,  473
970 DATA   233,  185,  255,  255,   54,  156,    0,  154, 1212
980 DATA   255,  255,    0,    0,  186,    1,  186,    0,  723
990 DATA   154,   89,    0,    0,    0,  134,  196,  232,  885
1000 DATA    2,    0,  134,  196,   88,  192,  232,    4,  840
1010 DATA  232,    3,    0,   88,   36,   15,    4,  144,  522
1020 DATA   39,   20,   64,   39,  178,  195,    5,    0,  532
1030 DATA    3,    1,   49,    1,    1,    0,    5,    0,   60
1040 DATA    3,    1,  155,    0,    1,    0,  137,    0,  297
1050 DATA    3,    1,   18,    1,    1,    0,  138,    0,  162
1060 DATA    3,    1,   48,    1,    1,    0,   59,    0,  105
1070 DATA    3,    1,  122,    0,    1,    0,   78,    0,  197
1080 DATA    0,    0,    0,    0,    0,    0,    0,    0,    0
1090 DATA   13,   10,   83,  121,  110,  116,   97,  120,  670
1100 DATA   58,   32,   68,   85,   77,   80,   32,  102,  534
1110 DATA  105,  100,  101,  110,   97,  109,  101,   13,  744
1120 DATA   10,   10,   48,   67,   41,   32,   49,   57,  306
1130 DATA   56,   56,   44,   32,   98,  105,  102,  102,  507
1140 DATA   45,   68,   97,  110,  105,  115,   32,   67,  647
1150 DATA  111,  109,  109,  117,  110,  105,   99,   97,  857
1160 DATA  116,  105,  111,  110,  115,   32,   67,  111,  767
1170 DATA   46,   13,   10,   80,  114,  111,  103,  114,  591
1180 DATA   97,  109,  109,  101,  100,   32,   98,  121,  767
1190 DATA   32,   67,  104,   97,  114,  108,  101,  115,  738
1200 DATA   32,   80,  101,  116,  122,  111,  108,  108,  770
1210 DATA   44,   32,   49,   50,   47,   56,   55,   13,  346
1220 DATA   10,   68,   85,   77,   80,   58,   32,   78,  488
1230 DATA  105,  108,  101,   32,  110,  111,  116,   32,  715
1240 DATA  102,  111,  117,  110,  100,   32,  111,  114,  797
1250 DATA   32,   99,   97,  110,  110,  111,  116,   32,  787
1260 DATA   98,  101,   32,  111,  112,  101,  110,  101,  766
1270 DATA  100,    9,   32,   44,   59,   61,    0,    0,  305
```

Figure 2: *A DUMP.BAS program that will create DUMP.EXE.*

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Date/time-stamp documents	Yes	No

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dure for a simple program such as DUMP.

Bit 8 is set to 1 when the segment includes relocation information. This bit is set for segment 1 but not for segment 2. I'll describe this relocation information toward the end of this column.

EXPANDING THE SEGMENTS Notice that the segment table contains two sizes: the first is the size of the segment in the file; the second is the size of the segment in memory. For the code segment, these two values are the same, but for the data segment the values are different.

When OS/2 loads DUMP.EXE's data segment into memory, it must first allocate a segment that is 310h bytes long. The data segment in the DUMP.EXE file is loaded into the first 96h bytes of this memory seg-

```
0000-0000  4D 5A 16 01 02 00 00 00-04 00 00 00 FF FF 00 00  MZ..............
0000-0010  B0 00 00 00 00 00 00 00-40 00 00 00 00 00 00 00  ........@.......
0000-0020  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00  ................
0000-0030  00 00 00 00 00 00 00 00-00 00 00 00 80 00 00 00  ................

0000-0040  0E 1F BA 0E 00 B4 09 CD-21 B8 01 4C CD 21 54 68  ........!..L.!Th
0000-0050  69 73 20 70 72 6F 67 72-61 6D 20 63 61 6E 6E 6F  is program canno
0000-0060  74 20 62 65 20 72 75 6E-20 69 6E 20 44 4F 53 20  t be run in DOS
0000-0070  6D 6F 64 65 2E 0D 0A 24-00 00 00 00 00 00 00 00  mode...$........

0000-0080  4E 45 05 00 64 00 02 00-B3 F6 32 7E 02 00 02 00  NE..d.....2~....
0000-0090  00 00 00 00 10 00 01 00-10 03 02 00 02 00 01 00  ................
0000-00A0  0C 00 40 00 50 00 50 00-58 00 5A 00 E6 00 00 00  ..@.P.P.X.Z.....
0000-00B0  00 00 04 00 00 00 00 00-00 00 00 00 00 00 00 00  ................
0000-00C0  10 00 4E 01 00 0D 4E 01-20 00 96 00 01 0C 10 03  ..N...N.(.......
0000-00D0  04 44 55 4D 50 00 00 00-01 00 00 00 44 4F 53 43  .DUMP.......DOSC
0000-00E0  41 4C 4C 53 00 00 08 44-55 4D 50 2E 45 50 45 00  ALLS...DUMP.EXE.
0000-00F0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00  ................

0000-0100  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00  ................
0000-0110  1E 07 0E D0 8B F3 AC 0A-C0 75 FB AC 0A C0 74 1E  .........u....t.
0000-0120  BF 91 00 B9 05 00 F2 AE-74 F1 8B D6 4A AC BF 91  ........t...J...
0000-0130  00 B9 06 00 F2 AE 75 F5-C6 44 FF 00 EB 1F 06 1F  ......u..D......
0000-0140  BA 00 00 B9 69 00 6A 02-1E 52 51 1E 60 A2 00 9A  ....i.j..RQ.h...
0000-0150  FF FF 00 00 6A 01 6A 01-9A FF FF 00 00 1E 06 1F  ....j.j.........
0000-0160  07 06 52 1E 60 9C 00 1E-60 9E 00 6A 00 6A 00 6A  ..R.h...h..j.j.j
0000-0170  00 6A 01 6A 20 6A 00 6A-00 9A FF FF 00 00 0B C0  .j.j j.j........
0000-0180  74 08 BA 69 00 B9 28 00-EB BC 1E 07 FF 36 9C 00  t..i..(......6..
0000-0190  1E 68 A4 00 6A 10 1E 60-A0 00 9A FF FF 00 00 83  .h..j..h........
0000-01A0  3E A0 00 00 75 03 EB 7B-90 BF B4 00 A1 99 00 E8  >...u..{........
0000-01B0  03 00 B0 2D AA A1 97 00-E8 7A 00 B0 20 AA BE A4  ...-.....z.. ...
0000-01C0  00 8B 0E A0 00 2B DB B0-20 83 FB 00 75 02 B0 2D  .....+.. ...u..-
0000-01D0  AA AC E0 67 00 43 E2 EF-B9 10 00 2B CB 6B C9 03  ...g.C.....+.k..
0000-01E0  83 C1 02 B0 20 F3 AA BE-A4 00 0B 0E A0 00 AC 3C  .... ..........<
0000-01F0  20 72 04 3C 7F 72 02 B0-2E AA E2 F2 B0 0D AA B0   r.<.r..........
0000-0200  0A AA 81 EF B4 00 6A 01-1E 68 B4 00 57 1E 68 A2  ......j..h..W.h.
0000-0210  00 9A 50 00 00 00 03 06-97 00 10 83 16 99 00 00  ..P.............
0000-0220  E9 69 FF FF 36 9C 00 9A-FF FF 00 00 6A 01 6A 00  .i..6.......j.j.
0000-0230  9A 59 00 00 00 86 C4 E8-02 00 86 C4 50 C0 E0 04  .Y..........P...
0000-0240  E8 03 00 58 24 0F 04 90-27 14 40 27 AA C3 05 00  ...X$...'.@'....
0000-0250  03 01 31 01 01 00 05 00-03 01 9B 00 01 00 89 00  ..1.............
0000-0260  03 01 12 01 01 00 8A 00-03 01 20 01 01 00 3B 00  .......... ...;.
0000-0270  03 01 7A 00 01 00 46 00-00 00 00 00 00 00 00 00  ..z...F.........

0000-0200  0D 0A 53 79 6E 74 61 78-3A 20 44 55 4D 50 20 66  ..Syntax: DUMP f
0000-0290  69 6C 65 6E 61 6D 65 0D-0A 0A 44 55 4D 50 20 20  ilename...DUMP
0000-02A0  63 29 20 31 39 38 38 2C-20 5A 69 66 66 20 43 6F  c) 1988, Ziff Co
0000-02B0  6D 6D 75 6E 69 63 61 74-69 6F 6E 73 20 43 6F 2E  mmunications Co.
0000-02C0  0D 0A 50 43 20 4D 61 67-61 7A 69 6E 65 20 FE 20  ..PC Magazine .
0000-02D0  43 68 61 72 6C 65 73 20-50 65 74 7A 6F 6C 64 20  Charles Petzold
0000-02E0  2D 20 31 32 2F 30 37 0D-0A 44 55 4D 50 3A 20 46  - 12/07..DUMP: F
0000-02F0  69 6C 65 20 6E 6F 74 20-66 6F 75 6E 64 20 6F 72  ile not found or
0000-0300  20 63 61 6E 6E 6F 74 20-62 65 20 6F 70 65 6E 65   cannot be opene
0000-0310  64 09 20 2C 3B 3D                               d. ,;=
```

DOS .EXE header

DOS program

New .EXE header

Code segment and relocation information

Data segment

Figure 3: *The five major sections of the OS/2 DUMP.EXE file.*

```
0000-0000   4D 5A 16 01 02 00 00 00-04 00 00 00 FF FF 00 00   MZ..............
0000-0010   B8 00 00 00 00 00 00 00-40 00 00 00 00 00 00 00   ........@.......
0000-0020   00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000-0030   00 00 00 00 00 00 00 00-00 00 00 00 80 00 00 00   ................
```

Offset in file where new .EXE header begins

Figure 4: *OS/2 uses the double word at 3Ch to determine where the new .EXE header is located.*

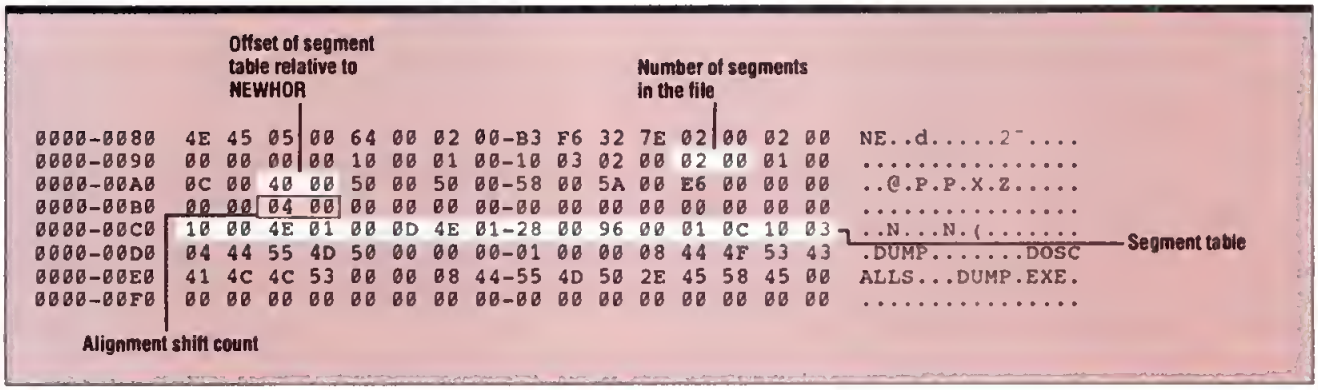


Figure 5: *OS/2 uses information in the new header to identify the code and data segments of the program.*

ment. The rest of the segment is initialized to zero.

In DUMP.ASM (Figure 1), the segments identified with the .STACK, .DATA, and .DATA? keywords are consolidated into one segment group, often called DGROUP. If you compare the .DATA and .DATA? segments in DUMP.ASM (Figure 1) with the data segment in DUMP.EXE (Figure 3), you'll notice that the data segment in the file encompasses only the data initialized to something other than zero. Everything in .DATA? (plus the last few bytes in .DATA) does not require space in the .EXE file because OS/2 initializes the variables to zero when the program is loaded into memory.

When programming for OS/2 in assembly language, keep this in mind. Any variable you want initialized to zero can go in the .DATA? segment or at the end of the .DATA segment; this approach prevents these variables from taking up space in the .EXE file. Do *not* do something like this:

```
.DATA

Data1   db   "Some data"
Data2   db   256 dup (0)
Data3   db   "More data"
```

Because the assembler will not reorder variables, this code will require 256 bytes of zeros in the .EXE file's data segment.

ENTRY CONDITIONS Other information in the header section of the file indicates how OS/2 is to set registers on entry to the program. This part of the hex dump is shown in Figure 6.

The word at offset (NEWHDR + 0Eh) is the segment number of the "automatic data segment." In DUMP.EXE this word is set to 2, which indicates segment 2, or the data segment. The automatic data segment, which is often called DGROUP, contains the program's stack. On entry to the program, DS is set to the address of this segment and CX is set to the segment's size (310h).

The double word at offset (NEWHDR

DUMP.EXE's Segment Table

	Segment 1	Segment 2
Location of segment in file	0010	0028
Size of segment in file	014E	0096
Flags	0D00	0C01
Size of segment in memory	014E	0310

The segment table in an OS/2 .EXE file has four words for each code and data segment in the program.

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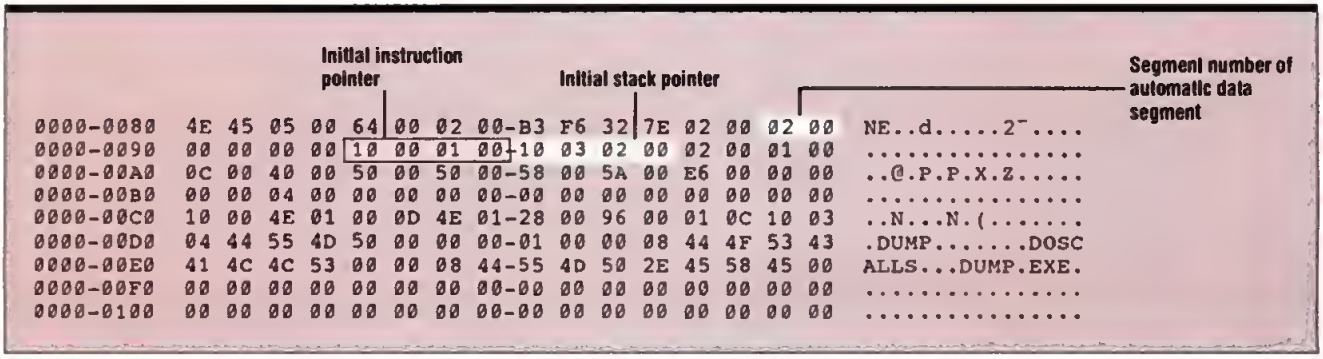


Figure 6: *Information in the header section indicates entry conditions for the program.*

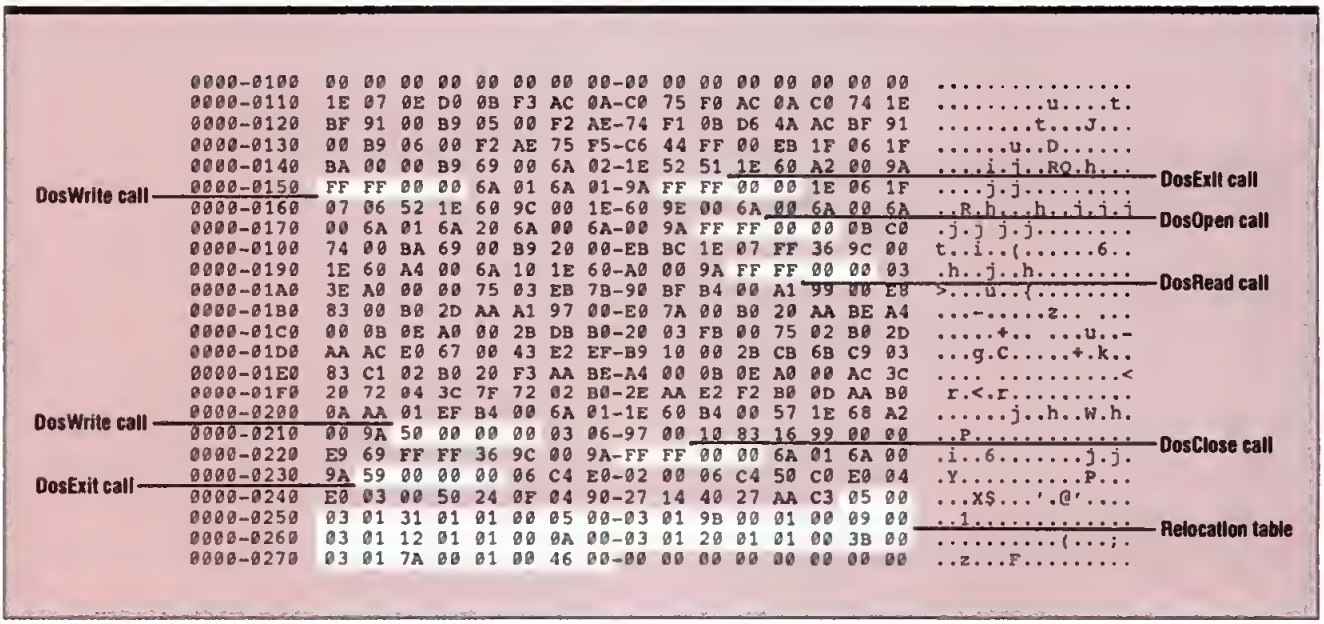


Figure 7: *The code segment in DUMP.EXE contains relocation information for dynamic linking.*

+ 14h) is the initial value of the instruction pointer on entry to the program. The first word is the offset (10h in DUMP.EXE) and the second word is the segment number—segment 1, or the code segment.

The double word at offset (NEWHDR + 18h) is the initial value of the stack pointer. In DUMP.EXE this indicates segment 2 (the data segment) and offset 310h, which is the very top of segment 2 after it has been expanded in memory. In DUMP .ASM, a stack size of 200h was specified. The size of the data segment (310h) is enough to accommodate the total size of the initialized data, the uninitialized data, and the 200h-byte stack.

DYNAMIC LINKING The New Executable format must also support dynamic linking. Code segments that contain calls to OS/2 functions are followed by a "relocation table" in the .EXE file. This table is used with information in the header to resolve calls to OS/2 functions when the program is loaded into memory.

■ Code segments that contain calls to OS/2 functions are followed by a "relocation table."

I've described how dynamic linking works in previous Environments columns. Basically, OS/2 inserts the addresses of OS/2 functions into a program's code segment when the program is executed. It is instructive to see how this information is encoded into the .EXE file.

Figure 7 shows DUMP.EXE's code segment. The calls to OS/2 functions in DUMP.EXE are coded as far calls (whose op-code is 9Ah), followed by an offset and segment address. Figure 7 shows these ad-

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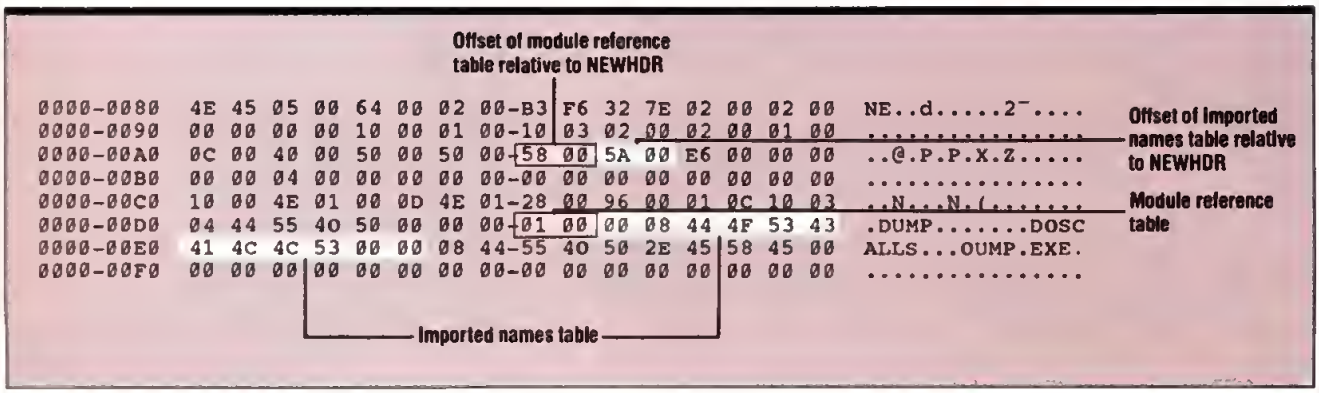


Figure 8: *Tables in the header aid in resolving calls to dynamic link libraries.*

dresses for each of the seven OS/2 functions that DUMP.EXE calls. You'll notice that most of these addresses are coded as 0000:FFFF, which is an impossible address for a far call. It's a dummy address because the addresses of these functions are not known until the program is run.

The segment table indicates that the code segment is 14Eh bytes long. This means the information that starts at offset 24Eh in the DUMP.EXE file is not part of the code segment. In fact, it's the relocation table.

In medium or large model programs, this relocation table could also contain information necessary to adjust far calls between code segments. However, in DUMP.EXE, the relocation table contains only dynamic link information.

The table begins with a word that indicates the number of entries in it. In DUMP.EXE this is 5. Not coincidentally, this is the number of unique OS/2 functions called by the program (DosWrite, DosExit, DosOpen, DosRead, and DosClose).

Each entry in the relocation table is 8 bytes long. Let's take a look at the first entry. The first byte is a 3. This indicates that the adjustment to be made to the code segment is to a far address (both segment and offset). The second byte is a 1, which means that the far address in the code segment must be set to an ordinal number representing the address of a routine in a dynamic link library.

■ OS/2 does not really have a DOSCALLS.DLL library. The functions are part of IBMDOS.COM.

This is followed by the word 131h—an offset relative to the beginning of the code segment showing where the adjustment is to be made. This is actually offset 231h in the DUMP.EXE file, which corresponds to the last DosExit call. The relocation table entry continues with two words: a 1 and a 5. The 1 indicates a particular dynamic link library, the 5, the ordinal number of the function in that library.

Hold onto your hats. This gets insane: the 1 in the relocation table that indicates the particular dynamic link library is actually an index into the "module reference table," which is another table in the header section. The offset of the module reference table relative to NEWHDR is stored at (NEWHDR + 28h), which contains the word 58h. Thus, the module reference table begins at (NEWHDR + 58h) or D8h. The first word found there (since we're dealing with an index of 1) is another 1.

This number represents an offset into the "imported names table." The offset of the imported names table relative to NEWHDR is stored at (NEWHDR + 2Ah), which contains 5Ah. The imported names table thus begins at (NEWHDR + 5Ah), or DAh. One byte into the imported names table is the number 8, followed by the string "DOSCALLS". (The 8 is the number of characters in "DOSCALLS".) These tables are shown in Figure 8.

What this means is that the far address at offset 131h in DUMP.EXE's code segment must be set by OS/2 to the address of function 5 in the DOSCALLS dynamic link library. This function happens to be DosExit. (OS/2 does not really have a DOSCALLS.DLL dynamic link library.

DUMP.EXE's OS/2 Function Calls

Offset in code segment	Ordinal number	Function
131h (also 59h)	5h	DosExit
9Bh	89h	DosRead
112h (also 50h)	8Ah	DosWrite
128h	3Bh	DosClose
7Ah	46h	DosOpen

OS/2 uses the relocation table to identify and fix all the calls a program makes to OS/2 functions.

The DOSCALLS functions are actually part of IBMDOS.COM.)

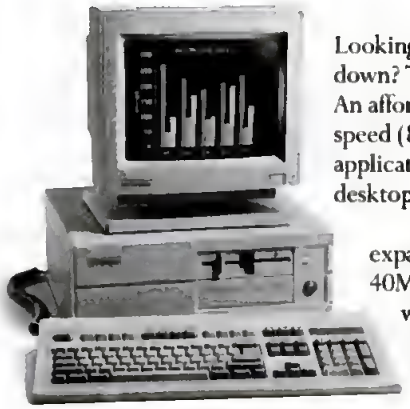
The far address at offset 131h in DUMP .EXE's code segment is not 0000:FFFF (like most of the others) but 0000:0059. This means that there is another call to DosExit in DUMP.EXE. It is located at 59h bytes from the beginning of the code segment—that is, at offset 159h in DUMP.EXE. The far address at 159h is 0000:FFFF. This marks the end of a chain of DosExit calls in the segment.

OS/2 uses the other four entries in the relocation table similarly. This is shown in the table "DUMP.EXE's OS/2 Function Calls." When LINK is creating the DUMP.EXE file, how does it know that DosExit is function 5 in the DOSCALLS dynamic link library? That information is in the import library DOSCALLS.LIB. The sole purpose of DOSCALLS.LIB is to provide this information to LINK so LINK can construct this relocation table.

■ The OS/2 .EXE format is necessarily a bit more complex. Fortunately, you don't have to understand the new .EXE format to program for OS/2.

JUST A LITTLE MORE COMPLEX Of course, we haven't looked at all the information in the header section or at other ways the relocation table can be coded. For example, in OS/2 programs that contain calls to the VIOCALLS, KBDCALLS, and other dynamic link libraries, the functions are identified by name rather than ordinal number. Without a doubt, the OS/2 .EXE format is necessarily a bit more complex than the DOS .EXE format. Fortunately, as I said at the outset, you don't have to understand the new .EXE format to program for OS/2. PC

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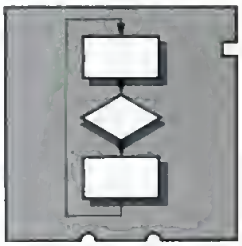
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FORMATTING DATE AND TIME IN C



The date and time functions contained in C libraries are seldom elegant. Here are some convenient C routines that will do a better job.

The need to format and display a time or date is common in both MASM and C applications. The runtime libraries of C compilers for MS-DOS contain a baroque hodgepodge of time and date functions. Some of these are descended from UNIX and make little sense transplanted into the MS-DOS environment; others are MS-DOS specific and thus idiosyncratic to each particular compiler. I find these routines to be unnecessarily clunky and complex. MASM programmers, of course, get no built-in support for time and date formatting from the translator at all, and typically they must roll their own routines.

In this column and the following, I'll present symmetric C and MASM routines that format an MS-DOS time and date into ASCII strings for display. To ensure maximum portability between C compilers, the C versions of the routines rely only on the `int86` library function, which loads the CPU registers with values from an array, executes a software interrupt, and then makes the returned register contents available to the calling program in another array. The code will work unchanged in either Turbo C or Microsoft C 5.0, and it can be easily adapted to any other MS-DOS C compiler.

DOS TIME AND DATE FORMATS

Application programs that run under MS-DOS must be able to deal with two distinct representations of the time and date used by that operating system. We can call these the "4-byte" formats and the "2-byte" formats. There is also a third format used internally by MS-DOS and the ROM BIOS, which represents the current time and date as the cumulative number of seconds since an arbitrary date and time, but since this format is not normally visible to application programs, we will not further concern ourselves with it here.

The 4-byte formats for the date and time are used by the MS-DOS function calls that deal directly with the system's real-time clock driver. These function calls are shown below.

Int. 21h Func.	Purpose
2Ah	Get system date
2Bh	Set systsm date
2Ch	Get system time
2Dh	Set system time

As shown in the diagram "Four-Byte Format Storage," this format is easy to work with, since each element of the time or date is stored in one or two complete bytes, with no need for shifts or masking of bits. Although the 4-byte time format provides for an accuracy of hundredths of seconds, the real-time clocks of most MS-DOS systems do not maintain time to this resolution. On PC compatibles, for example, the clock frequency is 18.2 Hz, which means the highest resolution to which you can measure elapsed time without a great deal of extra effort is approximately 0.055 seconds.

■ Application programs run under MS-DOS must be able to deal with two distinct representations of the time and date used by that operating system.

The 2-byte formats for date and time are principally used by MS-DOS in disk directories, and they are provided to application programs in connection with certain directory-related file management functions. These function calls are shown below.

Int. 21h Func.	Purpose
0Fh	Open file with FCB
11h	Search for first file
12h	Search for next file
16h	Create file with FCB
4Eh	Search for first file
4Fh	Search for next file
57h	Get/Set file date/time

The 2-byte formats pack the time and date into bit fields, shown in the diagram "Two-Byte Format Storage," which must be shifted and masked with AND operations to get at the information. In the case of the 2-byte format for time, some information is lost: seconds are only stored in units of two, and the hundredths-of-seconds information is not maintained at all.

INTERNATIONALIZATION A discussion of MS-DOS times and dates would be incomplete without mention of MS-DOS's internationalization support. The time or date is always provided to an application program by the operating system in the 4-

byte or 2-byte formats just described. To allow programs to adapt their display of this information to the needs of the user, MS-DOS also makes country-specific formatting information available via the "Get or Set Current Country" and "Get Extended Country Information" services (interrupt 21h functions 38h and 65h, respectively).

Function 38h, "Get or Set Current Country," is available in MS-DOS, Versions 2.0 and later. It provides a table of information that includes date and time format codes, currency symbol, and separator characters for time, date, and decimal points. The operation of function 38h is controlled by the COUNTRY= directive in the system's CONFIG.SYS file, or by the OEM's selection of the "default country" if the COUNTRY= directive is absent. Unfortunately, use of this service is complicated by the fact that it was only partially implemented in PC-DOS, Versions 2.0 and 2.1, and the information provided to the program is in a somewhat different layout under PC-DOS 2.*x* than it is under MS-DOS, Versions 2.1 and later, and in PC-DOS, Versions 3.0 and later. The two tables "MS-DOS 2.0/PC-DOS 2.*x* International Information" and "MS-DOS 2.1+/PC-DOS 3.*x* International Information" show how the information is returned.

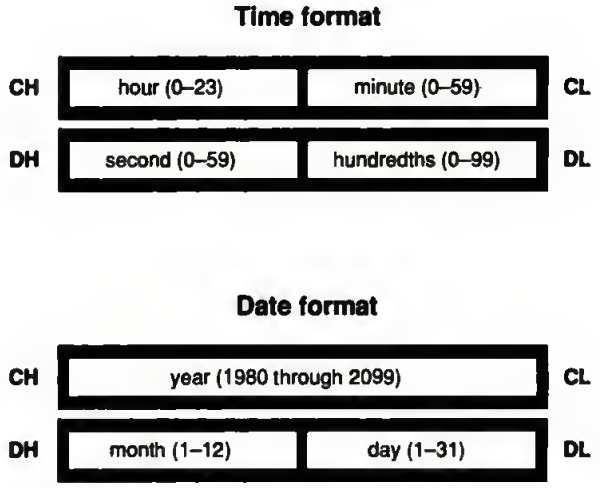
Interrupt 21h function 65h, "Get Extended Country Information," was added to PC-DOS and MS-DOS in Version 3.3 and returns a superset of the information provided by function 38h. Discussion of function 65h, "code pages," and other MS-DOS 3.3 enhancements to internationalization support will be deferred to a later column.

C TIME AND DATE ROUTINES

The source code listing TD.C contains the Power Programming time and date routines for C programmers. The table "TD.C Time and Date Routines and Syntax" shows the six different routines that may be called from your program.

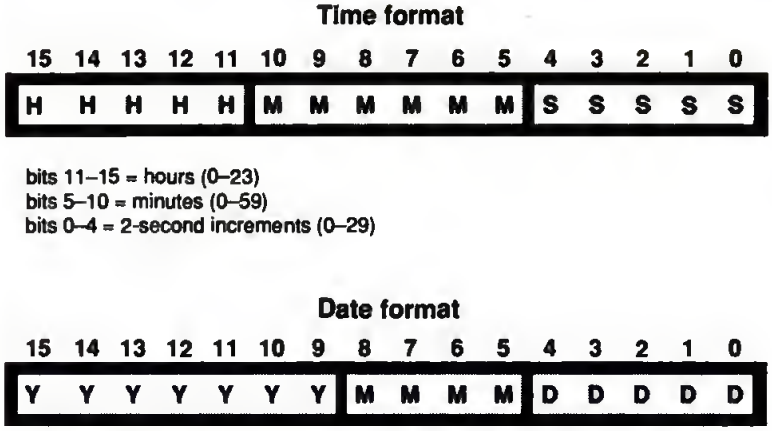
All of these routines accept a length, together with the other necessary information, and all return a pointer to a null-terminated ASCII string that can then be displayed with `printf` or its cousins. The string can also be incorporated into other

Four-Byte Format Storage



Four-byte time and date formats used by INT 21h functions 2Ah through 2Dh. These system services accept arguments or return results in registers CX and DX.

Two-Byte Format Storage



Two-byte time and date formats found in directory entries and file control blocks, and used by certain directory-related INT 21h functions.

MS-DOS 2.0/PC-DOS 2.*x* International Information

Byte	Contents
0–1	Date format; 0 = USA (m d y) 1 = Europe (d m y) 2 = Japan (y m d)
2–3	ASCIIZ currency symbol
4–5	ASCIIZ thousands separator
6–7	ASCIIZ decimal separator
8–31	Reserved

The internationalization information returned by INT 21h function 38h under MS-DOS 2.0 and PC-DOS 2.*x*.

MS-DOS 2.1+/PC-DOS 3.*x* International Information

Byte	Contents
0–1	Date format; 0 = USA (m d y) 1 = Europe (d m y) 2 = Japan (y m d)
2–6	ASCIIZ currency symbol string
7–8	ASCIIZ thousands separator character
9–10	ASCIIZ decimal separator character
11–12	ASCIIZ date separator character
13–14	ASCIIZ time separator character
15	Currency format; bit 0 { = 0 if currency symbol precedes value = 1 if currency symbol follows value bit 1 { = 0 if no space between value and currency symbol = 1 if one space between value and currency symbol
16	Number of digits after decimal in currency
17	Time format; bit 0 { = 0 if 12-hour clock = 1 if 24-hour clock
18–21	Case map call address
22–23	ASCIIZ data-list separator
24–33	Reserved

The internationalization information returned by INT 21h function 38h under PC-DOS 3.*x* and MS-DOS, Versions 2.1 and later. The "case-map call address" is the segment and offset of a procedure that performs country-specific lowercase-to-uppercase mapping on character values from 80h through 0FFh.

strings or records with C string manipulation functions. The table "TD.C Time and Date Routines and Syntax" also summarizes the usage of these routines.

The formatted time string returned by these functions always takes the form

```
hh:mm:ss.dd
```

where *dd* is hundredths of seconds. The maximum length of the returned string is always 11 characters, regardless of the length specified by the calling program. The caller may specify a shorter length if it doesn't want to use all of the time fields. (A program can specify a length of five to display only the hours and minutes, for example.) If interrupt 21h function 38h is available, the delimiters ":" and "." are replaced by the appropriate time and decimal delimiters for the current country.

The default format for date strings is

```
mm-dd-yy
```

which is also known as the mdy (month-day-year) format. If interrupt 21h function 38h is available, the date format is controlled by the date code and date delimiters returned by that function instead.

The mdy format is the convention in the United States, but it is rarely seen overseas. In Europe, the usual format is dmy (day-month-year), while in Japan the ymd (year-month-day) ordering is used. The Japanese format actually makes the most sense for computer systems, since it allows files and records to be sorted on date strings without the need for any special routines to pick the date apart and put it back together again.

ROUTINE ANALYSIS Working from the bottom up, all of the date and time functions rely on the helper routine `getctry` to obtain internationalization information from MS-DOS if it is available, or to set up a default date code and date, time, and decimal delimiters if it is not (`getctry` sets a global flag so that it does its work only on the first call and exits immediately on subsequent calls). Except to use the date format code, `getctry` does not try to make sense of the varying levels of internationalization support present in Versions 2.*x* of MS-DOS and PC-DOS.

The routines that actually do all the formatting are `dcvt` (convert date to ASCII

■ POWER PROGRAMMING

```
/*
    TD.C:  Time & Date Formatting Functions

    Ray Duncan, December 1987

*/

#include <stdio.h>
#include <stdlib.h>
#include <doa.h>

union REGS regs;

char * systcvt(int);                    /* function prototypes */
char * sysdcvt(int);
char * dirtcvt(int, unsigned);
char * dirdcvt(int, unsigned);
char * tcvt(int, int, int, int, int);
char * dcvt(int, int, int, int);
void   getctry();

static char cbuff[34];                  /* receives country info */

static int cflag = 0;                   /* true if country info */
                                        /* present in cbuff */



/*
        Convert current system time to ASCII string.
*/

char * systcvt(int length)
{
    char *p;
    int hour, min, sec, csec;

    regs.a.aa = 0x2c00;                 /* get current time */
    int86(0x21, &regs, &regs);

    hour = regs.h.ch;                   /* extract hours, minutes, */
    min = regs.h.cl;                    /* seconds, and hundredths */
    sec = regs.h.dh;                    /* of seconds from registers */
    csec = regs.h.dl;

                                        /* convert it to ASCII */
    p=tcvt(length, hour, min, sec, csec);

    return(p);                          /* return pointer */
}


/*
        Convert current system date to ASCII string.
*/

char * sysdcvt(int length)
{
    char *p;
    int month, day, year;

    regs.a.aa = 0x2a00;                 /* get current date */
    int86(0x21, &regs, &regs);

    month = regs.h.dh;                  /* extract month, day, */
    day = regs.b.dl;                    /* year from registers */
    year = regs.a.cx - 1980;

                                        /* convert it to ASCII */
    p=dcvt(length, month, day, year);
    return(p);                          /* return pointer */
}


/*
        Convert time in directory format to ASCII string.
*/

char * dirtcvt(int length, unsigned dirtime)
{
    char *p;
    int hour, min, sec, csec;

    hour = (dirtime >> 11) & 0x1f;  /* isolate time fields */
    min = (dirtime >> 5) & 0x3f;
    sec = (dirtime & 0x1f) * 2;
    csec = 0;

                                        /* convert it to ASCII */
    p=tcvt(length, hour, min, sec, csec);

    return(p);                          /* return pointer */
}


/*
        Convert date in directory format to ASCII string.
*/

char * dirdcvt(int length, unsigned dirdate)
{
    char *p;
    int month, day, year;

    day = dirdate & 0x1f;           /* isolate date fields */
    month = (dirdate >> 5) & 0x0f;
    year = 80 + ((dirdate >> 9) & 0x3f);

                                        /* convert it to ASCII */
    p=dcvt(length, month, day, year);
    return(p);                          /* return pointer */
}


/*
        Convert hours, minutes, seconds, and hundredths
        of seconds to ASCII string, truncating string to
        lesser of specified length or 11 characters.
*/

char * tcvt(int length, int hour, int min, int sec, int csec)
{
    static char time[12];               /* receives formatted time */

    getctry();                          /* get country info */

    sprintf(time,"%02d%c%02d%c%02d%c%02d",
            hour, cbuff[13], min, cbuff[13], sec, cbuff[9], csec);
                                        /* truncate if necessary */
    time[(int) min(length, 11)] = 0;

    return(time);                       /* return pointer */
}


/*
        Convert month, day, and year to ASCII string, truncating
        string to lesser of specified length or 8 characters.
*/

char * dcvt(int length, int month, int day, int year)
{
    static char date[9];                /* receives formatted date */

    getctry();                          /* get country info */

    switch(cbuff[0])                    /* format by date code */
    {
        case 0:                         /* USA: m d y */
        sprintf(date,"%02d%c%02d%c%02d",
                    month, cbuff[11], day, cbuff[11], year);
            break;

        case 1:                         /* Europe: d m y */
        sprintf(date,"%02d%c%02d%c%02d",
                    day, cbuff[11], month, cbuff[11], year);
            break;

        case 2:                         /* Japan: y m d */
        sprintf(date,"%02d%c%02d%c%02d",
                    year, cbuff[11], month, cbuff[11], day);
            break;
    }

    date[(int) min(length, 8)] = 0; /* truncate string */

   return(date);                        /* return pointer */
}


/*
        Get MS-DOS internationalization information into
        'cbuff', or provide default information.
*/

void getctry()
{
    int dosver;

    if(cflag) return;                   /* exit if information */
                                        /* already in buffer */

    memset(cbuff,0,34);                 /* initialize buffer */

    regs.a.aa = 0x3000;                 /* get MS-DOS version */
    int86(0x21, &regs, &regs);
    dosver = regs.h.al;

    if(dosver >= 2)                     /* if MS-DOS 2.x or 3.x */
    {                                   /* get country info */
        (char *) regs.x.dx = cbuff;
        regs.x.aa = 0x3800;
        int86(0x21, &regs, &regs);
    }

    if(dosver <= 2)                     /* if MS-DOS 1.x or 2.x */
    {                                   /* force delimiter info */
        cbuff[9]  = '.';                /* decimal separator */
        cbuff[11] = '/';                /* date separator */
        cbuff[13] = ':';                /* time separator */
    }

    cflag = -1;                         /* we've been here before */
}
```

TD.C: *Source code for the Power Programming time and date routines in C.*

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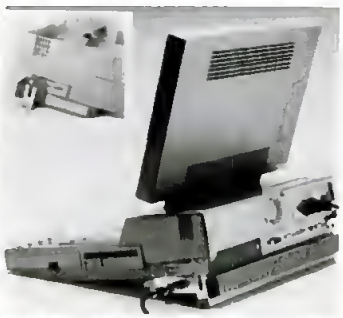
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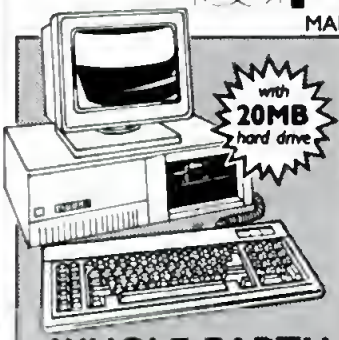
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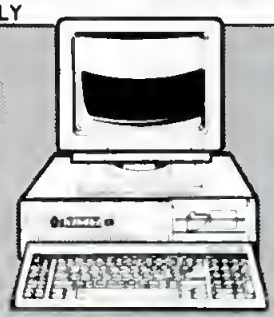
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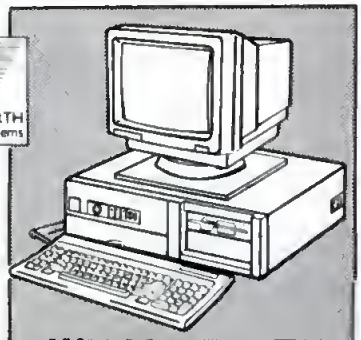
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■ POWER PROGRAMMING

```
/*
    TRYTD.C:    Demo of TD.C Time & Date Formatting Functions

    Ray Duncan, December 1987

    Compile:    C>CL TRYTD.C TD.C  <Enter>

*/

#include <stdio.h>
#include <stdlib.h>
#include <dos.h>

union REGS regs;

extern char * systcvt(int);         /* function prototypes */
extern char * sysdcvt(int);
extern char * dirtcvt(int, unsigned);
extern char * dirdcvt(int, unsigned);
extern char * tcvt(int, int, int, int, int);
extern char * dcvt(int, int, int, int);

main()
{
    char *tstr;                     /* pointer to formatted time */
    char *dstr;                     /* pointer to formatted date */
    unsigned dirtime,dirdate;

    tstr = systcvt(11);             /* format current time */
    dstr = sysdcvt(8);              /* format current date */

                                    /* display time & date */
printf("\nThe current time and date are: %s %s\n", tstr, dstr);

regs.x.ax = 0x3d00;                 /* open TRYTD.EXE file */
(char * ) regs.x.dx = "TRYTD.EXE";
int86(0x21, &regs, &regs);

if(regs.x.cflag)                    /* exit if open failed */
{   puts("Can't open TRYTD.EXE");
    exit(1);
}

regs.x.bx = regs.x.ax;              /* get file date & time */
regs.x.ax = 0x5700;
int86(0x21, &regs, &regs);
dirtime = regs.x.cx;
dirdate = regs.x.dx;

regs.x.ax = 0x3e00;                 /* close the file */
int86(0x21, &regs, &regs);          /* BX still has handle */

tstr = dirtcvt(11, dirtime);        /* format directory time */
dstr = dirdcvt(8, dirdate);         /* format directory date */

                                    /* display time & date */
printf("\nThe TRYTD.EXE file time and date are: %s %s\n",
        tstr, dstr);
```

TRYTD.C: *A simple demonstration of how to use the time and date routines in TD.C.*

string) and `tcvt` (convert time to ASCII string). Both `dcvt` and `tcvt` use `sprintf` to convert their binary arguments into an ASCII string in a static character array. `Dcvt` uses a case statement, controlled by the date code obtained by `getctry`, to put the month, day, and year in the correct order for the current country. These functions use the length supplied by the caller (clamped to a maximum of 11 characters for times or 8 for dates) to store a null byte marking the end of the formatted string. They then return a pointer to the caller.

Note: the string built by `dcvt` or `tcvt` will be overwritten on the next call to the same function, so the string should be copied elsewhere if it is not going to be used immediately.

The `sysdcvt` and `systcvt` routines are very simple. They use the `int86` function to obtain the current date or current time, respectively, convert the various time or date fields from the `int86` register array into normal integers, and then call `dcvt` or `tcvt` to do the actual formatting. Similarly, the routines `dirdcvt` and `dirtcvt` merely use shifts and logical AND operations to convert the time and date bit fields into normal integers, then call `dcvt` or `tcvt`.

TIME AND DATE DEMO The program TRYTD.C provides a simple example of the use of the time and date routines in TD.C. It calls `systcvt` and `sysdcvt`

TD.C Time and Date Routines and Syntax

Function	Purpose	Syntax
`tcvt`	Convert binary time to ASCII string	char *p; int length, hour, min, sec, csec; p = tcvt(length, hour, min, sec, csec);
`dirtcvt`	Convert time in directory (2-byte) format to ASCII string	char *p; int length; unsigned dirtime; p = dirtcvt(length, dirtime);
`systcvt`	Convert current time to ASCII string	char *p; int length; p = systcvt(length);
`dcvt`	Convert binary date to ASCII string	char *p; int length, month, day, year; p = dcvt(length, month, day, year);
`dirdcvt`	Convert date in directory (2-byte format) to ASCII string	char *p; int length; unsigned dirdate; p = dirdcvt(length, dirdate);
`sysdcvt`	Convert current date to ASCII string	char *p; int length; p = sysdcvt(length);

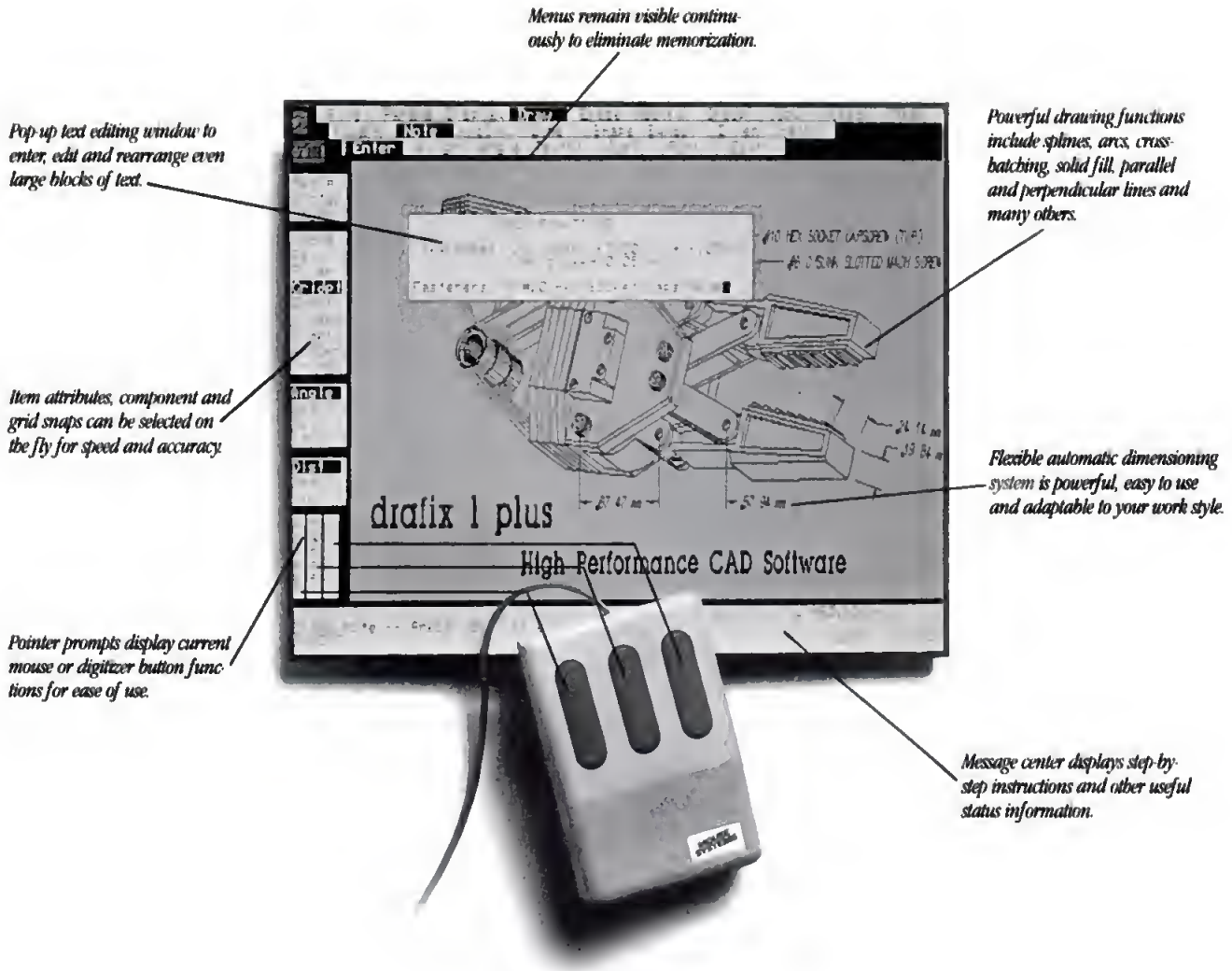
The name, purpose, and syntax for each of the TD.C time and date routines.

```
The current time and date are: 23:56:06.50 01-02-88
The TRYTD.EXE file time and date are: 12:15:16.00 01-01-88
```

Figure 1: *A typical display produced by TRYTD.EXE.*

```
The current time and date are: 23.56.37,87 02.01.88
The TRYTD.EXE file time and date are: 12.15.16,00 01.01.88
```

Figure 2: *Typical output from TRYTD.EXE when configured for West Germany.*



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to format the current system time and date, then displays them with `printf`. It then uses the MS-DOS Open (interrupt 21h function 3Dh) and Get File Date and Time (interrupt 21h function 57h) services to obtain the time and date of its own file on the disk, and then it calls the `dirdcvt` and `dirtcvt` routines to format them for use with `printf`, too.

To compile both TRYTD.C and TD.C into .OBJ files and then link them into the executable file TRYTD.EXE, simply enter the following command (Microsoft C 5.0):

```
CL TRYTD.C TD.C
```

If compilation and linking are successful, entering the command

```
TRYTD
```

should result in a display similar to that in Figure 1.

You can experiment with the effect of the internationalization information obtained by `getctry` with interrupt 21h function 38h by adding different COUNTRY= commands to your CONFIG.SYS file and restarting the system. For example, if you add the line COUNTRY=049 to your CONFIG.SYS file, which configures the system for use in West Germany, TRYTD.EXE will produce output similar to that shown in Figure 2.

Note the external function declarations for the various routines in TD.C at the beginning of the TRYTD.C program. These inform the compiler that the time and date routines are not to be found in the current source file but will be combined into the program at link time. They also assist the compiler in its error checking, since they specify the types of arguments and results for each routine. You may want to extract these function declarations into a header file named TD.H, which can simply be #included in other C programs.

THE IN BOX Comments and suggestions about this column from *PC Magazine* readers are welcome! You can contact me by the following avenues of electronic mail:

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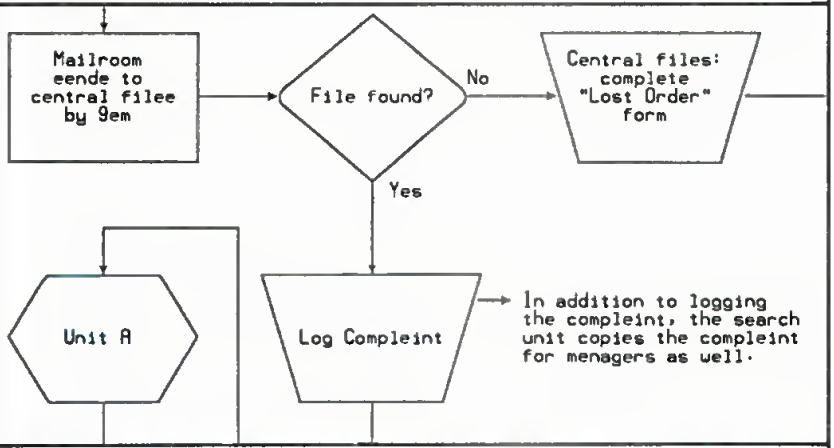
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* March 10, 1987 issue, page 278

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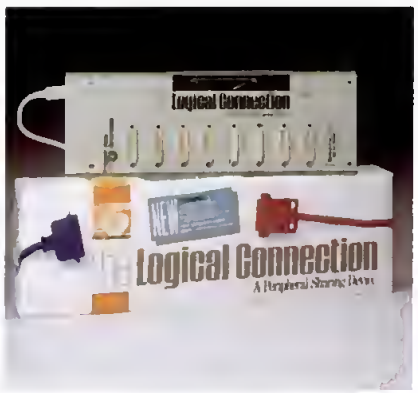
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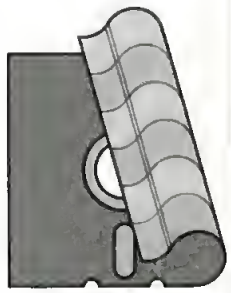
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CIRCLE 288 ON READER SERVICE CARD

■ DOUGLAS COBB AND STEVEN COBB

SPREADSHEET CLINIC



Restricting recalc to a single cell or range; getting where you were; undeleting range names; more on underlining labels; displaying dates in full format; an @IF anomaly.

RESTORING RANGE NAMES

The /Range Name Reset command makes it only too easy to delete all of the range names from a *1-2-3* worksheet. Many users have accidentally issued this command while trying to issue the /Range Name Labels Right command instead. Fortunately, I've discovered an easy way to restore the range names to a worksheet.

Every so often while working with a worksheet, I make use of the /Range Name Table command to create a table of the names and coordinates of the named ranges currently in the worksheet. Then if I accidentally delete the range names, I can restore them by positioning the cell pointer at the upper-left corner of the table and running the macro shown in Figure 1.

The first statement in this macro assigns the name TABLE to the first column of the table of range names. The second sets up a {For} loop that *1-2-3* executes as many times as there are rows in the table—that is, once for each named range in the worksheet.

The first statement in the loop copies the entry from the current cell (originally, the first cell in the column of range names) into the cell named NAME (the fifth statement in the loop). The cell pointer is then moved one cell to the right; this cell will contain the coordinates of the range whose name *1-2-3* just copied into NAME. The third statement in the loop copies the entry from that cell into the cell named ADDRESS (the seventh statement in the loop). The next five statements in the loop assign the range name stored in NAME to the cells whose coordinates are stored in ADDRESS. The final statement in the loop moves the cell pointer to the next range name in the table.

These steps are then repeated for each range name in the table, restoring all the range names to the worksheet in the process. For the technique to produce the results you want, of course the table of range names must be up-to-date.

James R. Knoblock
Clarksburg, West Virginia

	A	B
1	\a	/rncTABLE~{End}{Down}
2		{For COUNT,1,@ROWS(RTABLE),1,'LOOP}
3		
4	LOOP	{Let NAME,@CELLPOINTER("contents")}
5		{Right}
6		{Let ADDRESS,@CELLPOINTER("contents")}
7		/rnc
8	NAME	
9		~
10	ADDRESS	
11		~
12		{Left}{Down}
13		

Figure 1: *This macro restores the range names to a worksheet using the information in the table produced by the /Range Name Table command.*

	A	B
1	DOODADS	B24..E24
2	GADGETS	B25..E25
3	GIZMOS	B26..E26
4	THINGUMS	B27..E27
5	WIDGETS	B28..E28

Figure 2: *A table of range names for demonstrating an alternative technique of restoring the range names to a worksheet.*

Using the entries in a table of range names to restore the range names to a worksheet is a good idea. But we use these entries in another way. Specifically, we build string formulas that return macro statements which, when executed, rename the ranges specified in the table.

Suppose, for example, that you wanted to restore the range names listed in cells A1..A5 of the worksheet shown in Figure 2 to the ranges whose coordinates are listed in cells B1..B5. To do this, you would begin by entering the string formula

```
+"/rnc"&A1&"~"&B1&"~"
```

in cell C3. (Actually, any cell with four blank cells below it would do.) This formula would return the string

```
/rncDOODADS~B24..E24~
```

which is a macro statement that instructs

■ SPREADSHEET CLINIC

1-2-3 *to assign the range name DOODADS to cells B24..E24.*

After entering this formula into a cell, you'd copy it into the four cells immediately below. Since the references in the formula are relative, the copies of the formula will return a macro statement similar to the first one, only geared to the other names and coordinates in the table.

After creating these formulas, you would use the /Range Name Create command to assign a macro name to the cell that contains the first formula. When you play the macro, 1-2-3 *will execute the results of the five formulas, assigning the range names listed in cells A1..A5 to the ranges whose coordinates are listed in cells B1..B5.*

SEARCH AND RETURN, AGAIN

I read with interest the "Search and Return" letter from Nick Masque in the November 10, 1987, Spreadsheet Clinic. Although the /Copy command he suggests works, I prefer to use the Goto key when I need to browse another part of a worksheet, then return to my original position.

■ There are a variety of ways to do almost anything in *1-2-3*. We prefer the Goto key to the /Copy and + methods for browsing remote portions of a worksheet.

Once I hit the Goto, I can use any of the cursor-movement keys to move the cell pointer anywhere I want within the worksheet—even into title rows and columns. To return the cell pointer to its original starting point, I simply press Esc to cancel the Goto command. If I want to keep the cell pointer in the area I am browsing, I press Enter to complete the command.

Ralph L. Cumming
Arvada, Colorado

Once again, it's easy to see that there are a variety of ways to do almost anything in 1-2-3. *Personally, we prefer the Goto key to the /Copy and + methods for browsing remote portions of a worksheet.*

UNDERLINING LABELS, PART 2

The Spreadsheet Clinic for November 24, 1987, contained a letter that presented a formula for underlining labels. In your remarks, you warned that that formula would not work on centered or left-aligned labels.

I've developed formulas that work on labels with these two alternative alignments. To underline centered labels, I use a formula like that shown in Figure 3(a).

To underline right-aligned labels, I use a formula like that in Figure 3(b). In both cases, A1 represents the address of the cell I want to underline.

Robert D. Kaiser
McLean, Virginia

These formulas are a perfect complement to the first formula in the November 24 letter cited. Based on these three formulas, we developed the "universal" formula shown in Figure 3(c).

When you enter this formula, be sure to use the ! representation of the range references in this formula (for example, !A1). If you use traditional range references (like A1..A1), the formula will not fit into the cell. Since 1-2-3 *always displays references in full form on the Edit line, you won't be able to lock this formula back into its cell once you bring it back to the Edit line unless you convert the references back to ! form first.*

CALCULATING A SINGLE CELL

Here's a tip for anyone who has ever wanted to recalculate a single cell without recalculating his entire worksheet. Simply move the cell pointer to the cell that contains the formula or function you want to recalculate, press the F2 key to bring that formula to the Edit line, then press Enter to lock it back into the worksheet. As *1-2-3* locks the formula or function into the worksheet, it recalculates it.

Craig Israelsen
Provo, Utah

This simple trick works in Symphony, SuperCalc4, *and* Framework II *as well. Be careful, though—the result* may *not be an accurate recalculation of the formula or function. If the formula or function you are recalculating references a formula or function whose result is out of date, your*

```
(a)

@REPEAT(" ",@INT((@CELL("width",tA1)-@LENGTH(A1))/2))
&@REPEAT("=",@LENGTH(A1))

(b)

@REPEAT(" ",@CELL("width",tA1)-@LENGTH(A1)-1)
&@REPEAT("=",@LENGTH(A1))

(c)


@IF(@CELL("prefix",tA1)="'",
@REPEAT("=",@LENGTH(A1)),
@IF(@CELL("prefix",tA1)="^",
@REPEAT(" ",@INT((@CELL("width",tA1)-@LENGTH(A1))/2))
&@REPEAT("=",@LENGTH(A1)),
@REPEAT(" ",@CELL("width",tA1)-@LENGTH(A1)-1)
&@REPEAT("=",@LENGTH(A1))))
```

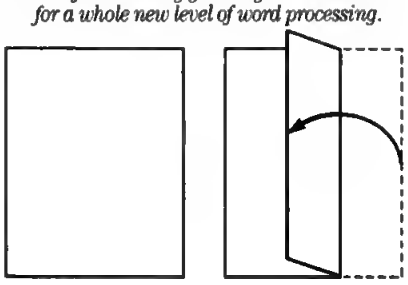
Figure 3: *A formula for underlining (a) centered and (b) right-aligned labels. The formula in (c) accommodates any alignment.*

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■ SPREADSHEET CLINIC

```
@CHOOSE(@MONTH(@NOW)-1, "January","February","March", "April","May","June","July",
"August","September","October", "November","December")&" " &@STRING(@DAY(@NOW),0)
 &",  19"&STRING(@YEAR(@NOW),0)
```

Figure 4: *A formula for converting* 1-2-3*'s all-numeric dates into full form.*

spreadsheet program will use that out-of-date result in its calculation.

Here's a similar tip: You can use the /Copy command to recalculate a range of adjacent cells. To do this, simply copy the range that you want to recalculate on top of itself. Like the Edit technique above, this one won't result in an accurate recalculation if any formulas or functions in the range reference unrecalculated formulas and functions outside of the range. It also may not return correct results if any of the formulas or functions in the range you are recalculating contain "forward" references to other formulas or functions within the range, since your spreadsheet program will recalculate the range in either a row-by-row or column-by-column fashion. You can solve the second problem by recalculating the range multiple times. The only good way to solve the first problem is to recalculate the entire worksheet.

CREATING A DATE FORMAT

I long wished that there was a way to display dates in *1-2-3* in "full" form, i.e., January 1, 1988 instead of 01-Jan-88 or 01/01/88. Although there isn't a built-in format that will display dates in this form, you can do it by using the formula shown in Figure 4.

Until Lotus adds a "full" date format to *1-2-3*, I guess I'll have to be content with this.

J. Stephen Tharp
Fresno, California

As Mr. Tharp states, this formula will display the current date—represented by the @NOW function—in full form. By substituting an @DATE function for the @NOW function, you can display any other date in this form.

A 1-2-3 MYSTERY

I've discovered a quirk in *1-2-3*'s @IF function that I cannot explain. Suppose cell C1 of a worksheet contains the function @IF(A1=1,B1,C1). If cell A1 contains the value 1, this function returns the entry from cell B1, whether that is a label or a value. If cell B1 contained the value 100, this function would return the value 100; if cell B1 contained the label 'test, this function would return the string "test".

If cell A1 contains a value other than 1, this function should return its previous result—that is, the result it returned the last time it was recalculated. This is precisely what happens if the function returned a value when it was last recalculated. For example, again suppose that cell A1 contains the value 1 and that cell B1 contains the value 100, so that the function in cell C1 returns the value 100. If you replace the value in cell A1 with a value other than 1, then change the value contained in cell B1, the function in cell C1 still will return the value 100.

For some reason, however, this @IF function does not work in the same way if it returned a string at the last recalc. For example, again suppose that cell A1 contains the value 1 and that cell B1 contains the label 'test, so that the function in cell C1 returns the string "test". If you replace the value in cell A1 with a value other than 1, then recalculate the worksheet, the function in cell C1 will return a null string—" "—not its previous result.

S. Polaniecki
New York, New York

We're baffled, too. Although we can't think of many situations in which you would want to use a function of this sort (partly because it creates a circular reference), we would expect 1-2-3 *to act the same way for both values and labels. Any suggestions?*

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■ PAUL SOMERSON

USER-TO-USER



How RECOVER can put you in peril; deep-freezing a PC to rescue a hard disk; patching EXE2BIN to work in DOS 3.3; running new programs with reserved filenames.

BETTER DRIVE SNIFFER

The batch file method of determining valid logical and physical drives, submitted by Ethan Winer (User-to-User, November 24, 1987), is fine as far as it goes. But as you pointed out, it thinks its job is done as soon as it finds the first "invalid" drive. Users who rely heavily on SUBST need more help in finding out exactly which drive letters are valid, since gaps in assignments are likely to exist.

The DRIVES.SCR script in Figure 1 will create DRIVES.COM, which scans the entire alphabet to report all valid drives, logical and physical, while ignoring the gaps. Type it in using a pure-ASCII word processor (omit the semicolons and the comments following them). Be sure to leave the blank line above RCX, and press the Enter key at the end of each line, especially the last one (with the Q). Then make sure DEBUG.COM is handy and enter the command

```
DEBUG < DRIVES.SCR
```

Instead of using the save/change/check drive technique, DRIVES, like COMMAND.COM, employs the esoteric DOS interrupt 21 function call 29h to check valid drives, as Charles Petzold rightly suggested in Part One of this ongoing saga (PC Tutor, April 14, 1987).

Gerald A. Monroe
Lakewood, Ohio

SUBST is a terrific keystroke saver, reducing complex pathnames down to manageable single letters. And if you have trouble remembering which of your programs are on which of your many drives, SUBST lets you use mnemonic labels (such as W: for the drive that holds WordStar*). DRIVES.COM will report all the drives you've currently nicknamed. But so will just typing SUBST. However, DRIVES.COM will report both logical and physical ones, something DOS can't do.*

```
N DRIVES.COM
A
NOP
MOV     SI,5C                   ; put dummy command line in PSP
MOV     DI,149                  ; destination of drive text
MOV     BYTE PTR [SI],40        ; hex value for "@"
INC     BYTE PTR [SI]           ; raise it to next letter
MOV     BYTE PTR [SI+0001],3A   ; put a colon after it
MOV     AX,2906                 ; parse dummy command line
INT     21
MOV     SI,5C                   ; point SI to output text
CMP     AL,FF                   ; AL = FFh if invalid drive
JZ      121                     ; jump if it is
MOV     CX,3                    ; queue up three characters
REPZ
MOVSB                           ; and move 'em
MOV     SI,5C                   ; set up SI for next pass
CMP     BYTE PTR [SI],5A        ; have we reached Drive Z?
JNZ     109                     ; loop back if not
MOV     AX,240A                 ; otherwise terminate string
STOSW
MOV     AH,9                    ; print it
MOV     DX,136
INT     21
INT     20                      ; and exit
DB      0D 0A "Valid drives are "
DB      "$"

RCX
4A
W
Q
```

Figure 1: *DRIVES.SCR file to create DRIVES.COM. Type it in using a pure-ASCII word processor (omit the semicolons and the comments following them). Be sure to leave the blank line above RCX, and press the Enter key at the end of each line, especially the last one (with the Q). Then make sure DEBUG.COM is handy and enter: DEBUG < DRIVES.SCR*

■ USER-TO-USER

RECOVERING FROM RECOVER

Much has been written in *PC Magazine* on how to protect against inadvertently formatting a hard drive. However, few users know about another extremely destructive DOS command—RECOVER.COM.

The DOS manual says RECOVER .COM is supposed to "recover files." Novice users who have lost or corrupted files may, in desperation, try this command without fully understanding what it does and accidentally type RECOVER C: at the DOS prompt. Even though DOS prints a warning message, most users will probably choose to type Y to proceed with the recovery.

RECOVER then does the following:

1) It removes the subdirectory structure from the disk.

2) It places all the files into the root directory.

3) It renames all files FILE0001.REC, FILE0002.REC, etc. . . .

The user is then forced to back up all of these similarly named REC files, reformat the disk, and then filter through the files to try and discover which file is which. I have yet to figure out any other way to recover from RECOVER.

The only consolation I could offer such users is to back up more frequently, get more information before using an unknown DOS command, and remove the RECOVER.COM program from their hard disks. It's important to remember that other DOS commands can be just as destructive as FORMAT although not as obvious.

Douglas E. Welch
Van Nuys, California

■ The description of RECOVER in the DOS manual is truly rotten and doesn't provide nearly enough warnings about how dangerous it is.

The description of RECOVER in the DOS manual is truly rotten and doesn't provide nearly enough warnings about how potentially dangerous it is. It's another case of the moronic names in DOS. DEBUG really ought to be called something friendlier like PATCHER or TOOLBOX. The IF ERRORLEVEL command should be called something like TEST. It's no wonder that a panicky and inexperienced user might think a command named RECOVER will fix his disk right up.

RECOVER isn't so bad if you ask it to dig out the pieces of just one file that had a sector go south somewhere. And if you've somehow wiped out your whole directory, laboriously sorting out the puzzle pieces of your text files is better than losing everything. But it's far too easy to wipe out a whole disk with it. Mr. Welch's suggestions are all good ones—back up often, plod through the manual before trying anything you're not familiar with, and take RECOVER.COM off your hard disk.

THE BIG CHILL

I support a large PC user community at General Electric's Wiring Device Department and had the misfortune of dealing with hard disk failures on five separate occasions (with IBM drives and external drives). Even with backups the problem always seemed to occur after lengthy sessions of adding new data. After trying every known technique of data recovery, I attempted a "cool" last-ditch effort that worked.

Since I was fortunate enough to have an environmental oven (used for high- and low-temperature testing of devices) handy, I tried heating and chilling the computers and drives, reasoning that thermal expansion or contraction might realign the heads with the data. In all five cases, cooling the drives down to approximately 40 degrees Fahrenheit did the trick. Once we recovered the data, we backed it up, replaced the drives, and copied the backed-up data onto the new drives.

While I can't predict that this would work in every case (it certainly would do nothing for a true head crash), I was amazed to find it worked each time I tried it. Since most users don't have access to an environmental oven, they could try putting the hardware in a standard refrigerator, which will cool it to the same approximate temperature. Keep in mind, however, that this technique should be the absolute last thing you attempt before replacing the drive and losing the data.

■ We don't recall seeing anything in the Guide to Operations voiding the warranty if users put their systems in refrigerators.

As responsible as people try to be with backups, the latest available copy is often several weeks out of date. Faced with the loss of critical data, users will try anything to recover it after a hard disk failure. The steps outlined above are not only effective, but safe for hardware in general and don't violate IBM's guidelines.

Robert M. Beatty
West Warwick, Rhode Island

It's true—we don't recall seeing anything in the Guide to Operations expressly voiding the warranty if users put their systems in refrigerators. And as Mr. Beatty says, when you're faced with losing all your data, you'll try just about any extreme, and this certainly qualifies as an extreme.

We're very careful about testing all submissions before we print them. Unfortunately, we also live in New York City, where the refrigerators are toy-sized. So we have to take Mr. Beatty's word for the effectiveness of this. However, note that in IBM's PC AT Technical Reference manual, the "Air Temperature" extremes are listed as:

System On: 15.6 to 32.2 degrees Celsius (60 to 90 degrees Fahrenheit)

System Off: 10 to 43 degrees Celsius (50 to 110 degrees Fahrenheit).

So chill out your disk drives at your own risk.

FOOLING COMMAND.COM

If you want to use batch files and/or programs that have filenames identical to in-

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CIRCLE 372 ON READER SERVICE CARD

■ USER-TO-USER

ternal DOS commands, just prefix them with drive letters. DOS will recognize them as files and search the PATH for them.

For example, to execute a customized DIR.COM program, type C:DIR. This saves you from having to patch COMMAND.COM.

Dr. Z. Barak
Downsview, Ontario
Canada

You shouldn't really have to patch COMMAND.COM, since you can almost always come up with a name that's slightly different from the actual internal DOS command. However, if you really need to duplicate the names of commands and filenames, this technique will work (in Versions 3.x). You may also prefix such a command with a pathname. And if you want to execute a file like this in the current directory, you can stick a .\ in front of it.

■ If you want to use batch files and/or programs that have filenames identical to internal DOS commands, just prefix them with drive letters.

So, typing the command

```
.\DIR
```

would run the DIR.COM or DIR.EXE or DIR.BAT program stored in the current directory.

VERSION MADNESS

I recently purchased a new IBM PS/2 Model 50 and a copy of DOS, Version 3.3. Unfortunately, IBM, for some incomprehensible reason, removed the program EXE2BIN.EXE from the DOS program diskettes; to obtain a copy of this program, one must purchase the DOS 3.3 Technical Reference manual, which means paying an extra $85.

Since I do a lot of assembly language programming, the EXE2BIN program is essential. Unfortunately, merely copying the old version from DOS 3.2 is no solution: running EXE2BIN.EXE under DOS 3.3 yields an error message "Incorrect DOS Version." So the unpleasant choice for recent purchasers is to shell out the money to buy a new Technical Reference manual.

EXE2BIN checks the DOS version number right after it's loaded and exits if it finds itself running under any version of

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DOS greater than 3.2. Nevertheless, simply changing the value of the byte at offset 30D will convert a JZ instruction to a JMP, causing the program to jump to the right place, regardless of what number the version test found.

To patch the 3.2 version of EXE2BIN .EXE so it runs under DOS 3.3, copy and rename your 3.2 version of EXE2BIN .EXE to EXE2BIN.XXX. Then patch the byte at address 30D from 71 to EB. Finally, rename the EXE2BIN.XXX file EXE2BIN.EXE. The whole process looks like the following:

```
A>COPY EXE2BIN.EXE EXE2BIN.XXX
A>DEBUG EXE2BIN.XXX
-E 30D EB
-W
Writing 0BF7 bytes
-Q
A>REN EXE2BIN.XXX EXE2BIN.EXE
```

Stephen R. Crutchfield
Washington, D.C.

■ There's always a reason for preventing a program that was written for one version of DOS from running under another version.

There's always a reason for preventing a program that was written for one version of DOS from running under another version. The reason could be a subtle problem caused by the version differences, or it could be a massive crash waiting to happen—or it could just be greed or laziness on the part of the manufacturer.

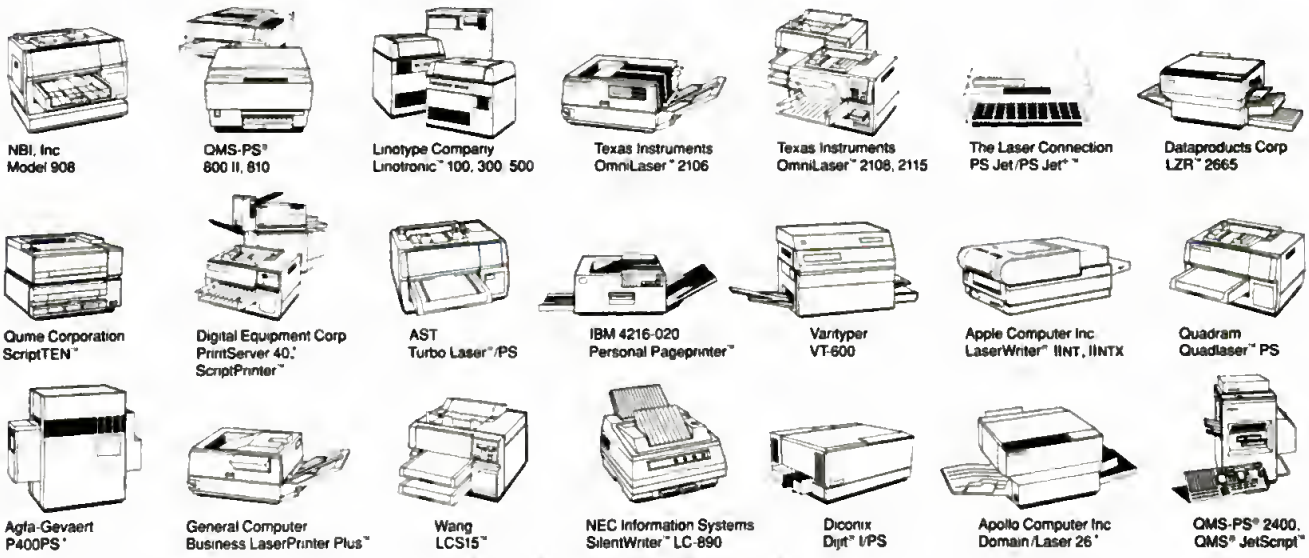
About a year ago, PC Magazine*'s First Looks section reviewed a public-domain EXE2BIN that worked under all versions when users first started noticing the problem (see* PC Magazine*, August 1987, page 46). But Mr. Crutchfield's technique is even easier.*

Remember to rename EXE2BIN.EXE before you load it into DEBUG so that it has a non-.EXE extension. Then when you're done patching it, rename it to put the .EXE extension back.

SHARE YOUR SECRETS

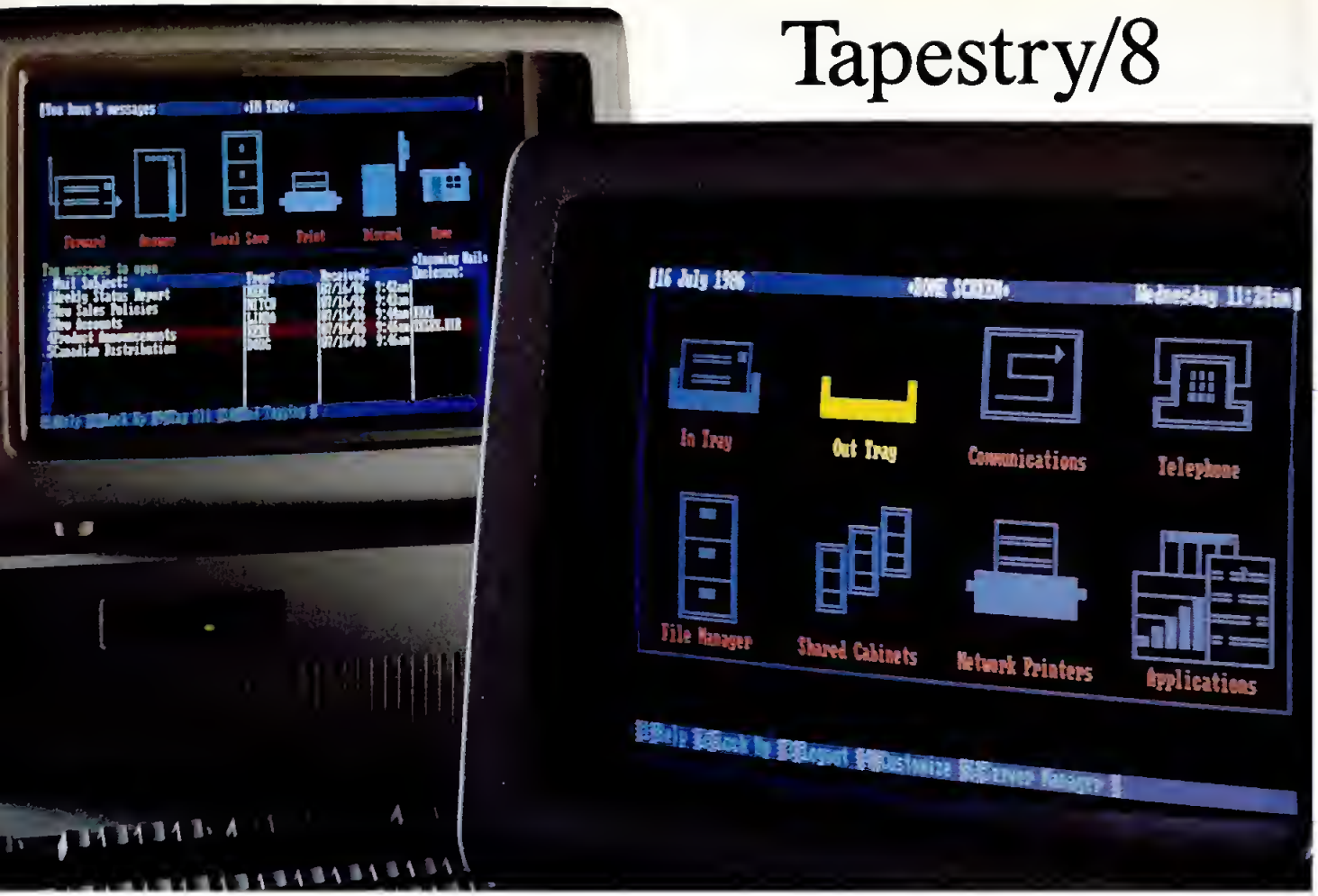
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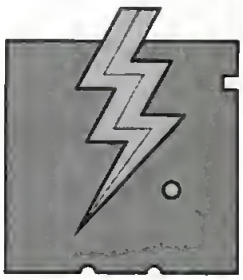
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CIRCLE 141 ON REAOER SERVICE CARD

■ EDITED BY CRAIG L. STARK



POWER USER

Improving dBASE file security and record appending; footnoting flexibility from Microsoft Word; WordPerfect macros for single-document memos and temporary margins.

IMPROVED MEMO MACRO

Glenda Hannon Luke's macro for writing a quick memo while taking dictation or doing something else (Power User, September 29, 1987) uses Doc 2 as a place to write the memo before saving it in a memo file. This requires that Doc 1 be nonempty and Doc 2 be empty. If Doc 1 is empty, the macro exits to DOS. If Doc 2 contains any text, you lose that text. The first condition is petty; the second is serious. I often use Doc 2 to compare texts, lift chunks from one draft to put in another, carry notes out of a note file in Doc 2 to an article in Doc 1, and so on.

I've written a version of the macro (Figure 1) that avoids Doc 2 completely. It slaps the memo into the middle of whatever is on the screen in Doc 1, copies it to its file when finished, and then returns the screen to normal. Even if your cursor is in the middle of a word, you can do no harm. A small added benefit is that the individual items in the memo file are neatly marked off from one another by asterisks.

This macro can be extremely useful, not only for someone taking dictation from the boss, but for anyone who, engrossed in a task that cannot be abandoned immediately, is suddenly reminded of something else that urgently needs doing.

Norman Zacour
Toronto, Ontario
Canada

It may be momentarily disconcerting to have your memo data appear right in the middle of your previous text, but this procedure definitely avoids other problems. If you want the appearance of a blank screen for your memos, you can simply insert lots of carriage returns and position your headings appropriately. Do note that the file MEMO.FIL (or whatever you choose to call it) must exist already before you can append anything to it. Also, you cannot enter a carriage return within a memo: when you hit Enter, the memo ends.

Because of a change in the behavior of "Append Block," this macro works only in WordPerfect, *Version 4.2.*

—Neil J. Rubenking

USEing BLANK FILENAMES

Software written in the *dBASE* language offers no built-in password security system, and if you have databases with sensitive information you may not want everyone to be able to edit, append, delete, or zap the data.

A simple solution is to insert CHR(255), which appears to be a CHR(32) space, as part of a filename or program. Then, for example, if you change the filename PAY_RATE.DBF to PAY RATE.DBF, the ordinary user will

```
<Ctrl-F10>                  Begin macro definition
<Alt-M>                     Attach it to the Alt-M key
<Home><Left>                Make sure the memo starts at the margin
<CR><CR>                    Put in a couple of blank lines
DATE:<Tab>                  Enter text "DATE:"
<Shft-F5>1<CR>              Insert text of current date
<CR>                        A blank line
SUBJECT:<Tab>               Enter text "SUBJECT:"
<Ctrl-PgUp><CR><CR><CR>     Allow for user entry
<CR>                        A blank line
TEXT:<Tab>                  Enter text "TEXT:"
<Ctrl-PgUp><CR><CR><CR>     Allow for user entry
<CR>                        A blank line
***                         Marker to separate memos
<Alt-F4>                    Block on
<Shft-F2>                   Reverse search
DATE:<F2>                   Search for "DATE:"
<Home><Left>                Move to margin
<Left><Left>                Grab the blank lines too
<Ctrl-F4>3MEMO.FIL<CR>      Append to the memo file
<Alt-F4>                    Block on
<F2>***<F2>                 Search for asterisks
<Del>Y                      Delete the block
<Down>                      current line may need reformatting
<Ctrl-F10>                  End macro definition
```

Figure 1: *A memo-making* WordPerfect *macro that avoids using Doc 2.*

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CIRCLE 345 ON READER SERVICE CARD

■ POWER-USER

attempt to enter a space between the Y and the R and won't gain access to the file.

To create the CHR(255) character, hold down the Alt key and enter 255 on the numeric keypad. This method of file security can be useful with other types of files, too.

Colin Cohen
Maplewood, New Jersey

While this technique won't stop a sophisticated snooper for long, it certainly has the advantage of simplicity, and it requires no programming whatever.

Many subtle variations can be played on this theme. For example, if you add the CHR(255) at the end of the filename, your snooper can take a DIR of files, see what appears to be a perfectly normal filename, and be completely unable to USE it. Or you could name your file with a single CHR(255); when a DIR is taken, all that appears for this file is a blank filename, and the unauthorized user may not realize that it even exists.

■ If you add CHR(255) at the end of the filename, your snooper can take a DIR, see what appears to be a normal filename, and be unable to USE it.

Still another variation is to create a subdirectory named CHR(255). Inside this subdirectory, you can keep any number of normally named databases and programs and an ordinary user will never perceive their existence at all. Incidentally, ProKey *users must enter Shift-Alt-255 rather than Alt-255; in all cases, remember to use the numeric keypad.*—Brad Stark

FOOTNOTES IN MICROSOFT WORD

Microsoft Word's automatic footnoting always starts with the number 1 at the beginning of a document or division. This is a problem if you split a long document into separate files and need to maintain continuous footnote numbers throughout the document.

You can get around the problem by putting a dummy page at the beginning of each file or division and inserting enough footnote references on it to bring the first reference in the new division up to the correct number.

To do this, go to the start of the division (usually the start of the file), and insert a page break. With the page marker highlighted, insert a line above it by hitting Enter, and move the highlight up to the new line. Then insert a footnote reference (<Esc>FF<Enter><Esc>JF) and copy the reference mark to the scrap (<Esc>C<Enter>).

Press Ins enough times that the last reference above the page marker is one less than the first reference in the division ought to be. If you have to insert more than a few dummy notes, it might be convenient to copy a group of ten references and insert them in batches.

Next, go to the F(ormat) D(ivision) P(age number) menu and set the starting page to one less than the starting page of the division. You'll have to adjust this if there are enough dummy footnotes to fill more than one page. Then repaginate the document to make sure that the starting page is correctly numbered, and check the number of the first real footnote to make sure it's right.

Finally, to avoid printing the dummy pages, go to the P(rint) O(ptions) menu and set the options to print a range of pages, starting with the first page you want to print.

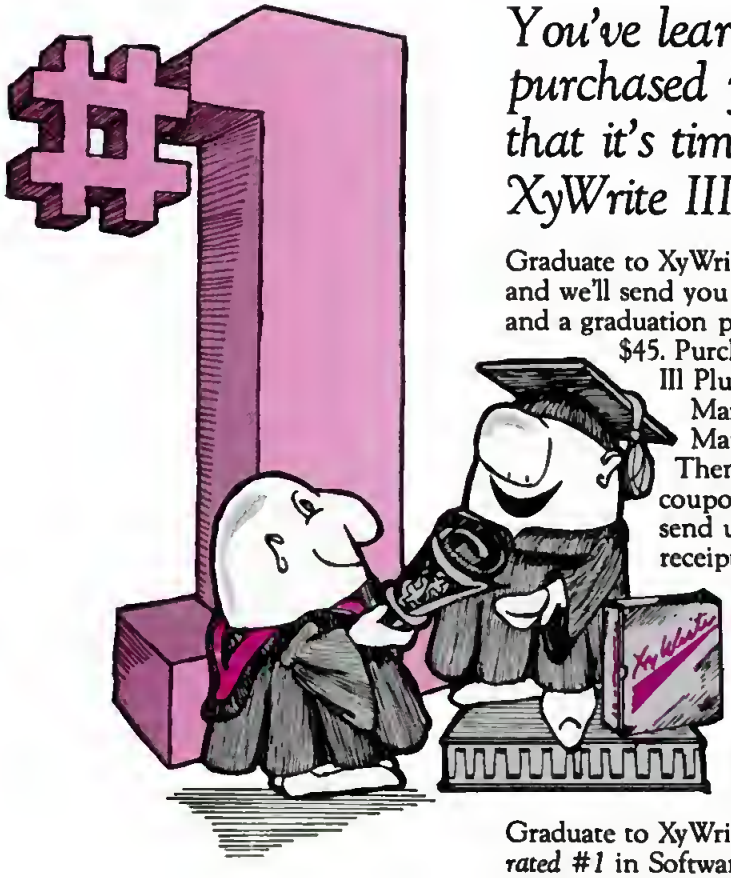
D. A. Johns
Gainesville, Florida

The one drawback to this trick is that every time you add or delete footnotes from an earlier division you have to adjust the number of dummy footnotes in later divisions. Still, this is a big improvement over not allowing continuous numbering at all.

Note also that you can use this trick for endnotes as well as footnotes. Simply insert two forced page breaks with <Ctrl-Shift-Enter>: one in the footnotes, just before the first "real" footnote, and one at the end of your text, before the marker Word *adds for endnotes. Alas, you will then have to print each file a second time,*

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CIRCLE 518 ON READER SERVICE CARD

■ POWER USER

```
<Ctrl-F10>          Begin macro definition
<Alt-C>             Name it ALT-C (for Center Tab)
<Shift-F6>          Center line
<Return>            End the center code
<Backspace>         Delete the [HRt] and position the cursor
<Ctrl-F10>          End macro definition
```

Figure 2: *A* WordPerfect *macro that puts the left edge of subsequent text at the midpoint of your margin settings.*

juggling the starting page numbers so that the endnotes print on the proper pages, but again, this is better than not being able to do the trick at all.—M. David Stone

CENTER TAB

The macro shown in Figure 2 is quite useful for creating a temporary "center tab" within your current margin settings. It works in *WordPerfect*, Versions 4.1 and 4.2 (and possibly others). You can combine it with a "Very truly yours"–type macro to begin the closing at the center of the document.

Kevin Bross
Burlington, Vermont

After using this macro, what you type starts at the center of the current margins and goes to the right. The left edge stays at the center—it doesn't move to keep the text centered. This isn't really a Center Tab; in fact it's entirely independent of the tab settings. That's what makes it so handy.—Neil J. Rubenking

FASTER THAN APPEND

APPEND is not always an efficient way to add data in *dBASE*. Consider the situation where you wish to append records from a large secondary file that is indexed on Date, and what you need to do is

```
APPEND FROM <secondary> FOR Date = <desired date>
```

Using this syntax, *dBASE* must scan through the entire secondary file to make sure it doesn't miss any records that fit the FOR condition. The problem is there is no WHILE condition with the APPEND command.

After testing, I have found that COPY runs faster than APPEND in all cases. Moreover, COPY allows the WHILE command, which stops execution as soon as the condition becomes false. So the faster way to integrate records in the above situation is

```
SELE <secondary>
* (it must be indexed on the key field)
FIND <desired date>
COPY TO temp WHIL Date = <whatever>
SELE A
APPE FROM temp
```

While this method also uses a final APPEND, there is no wasted motion. Timing tests on my AT indicate that this method will be faster than the straight APPEND when less than one-third of the secondary file will be APPEnded.

■ APPEND is not always an efficient way to add data in *dBASE* from a large secondary file.

Dung Quoc Vu
Fullerton, California

Another advantage is added control. Having created TEMP.DBF, you can quickly count, test, or massage the data before APPEnding the new records into your master file.—Brad Stark

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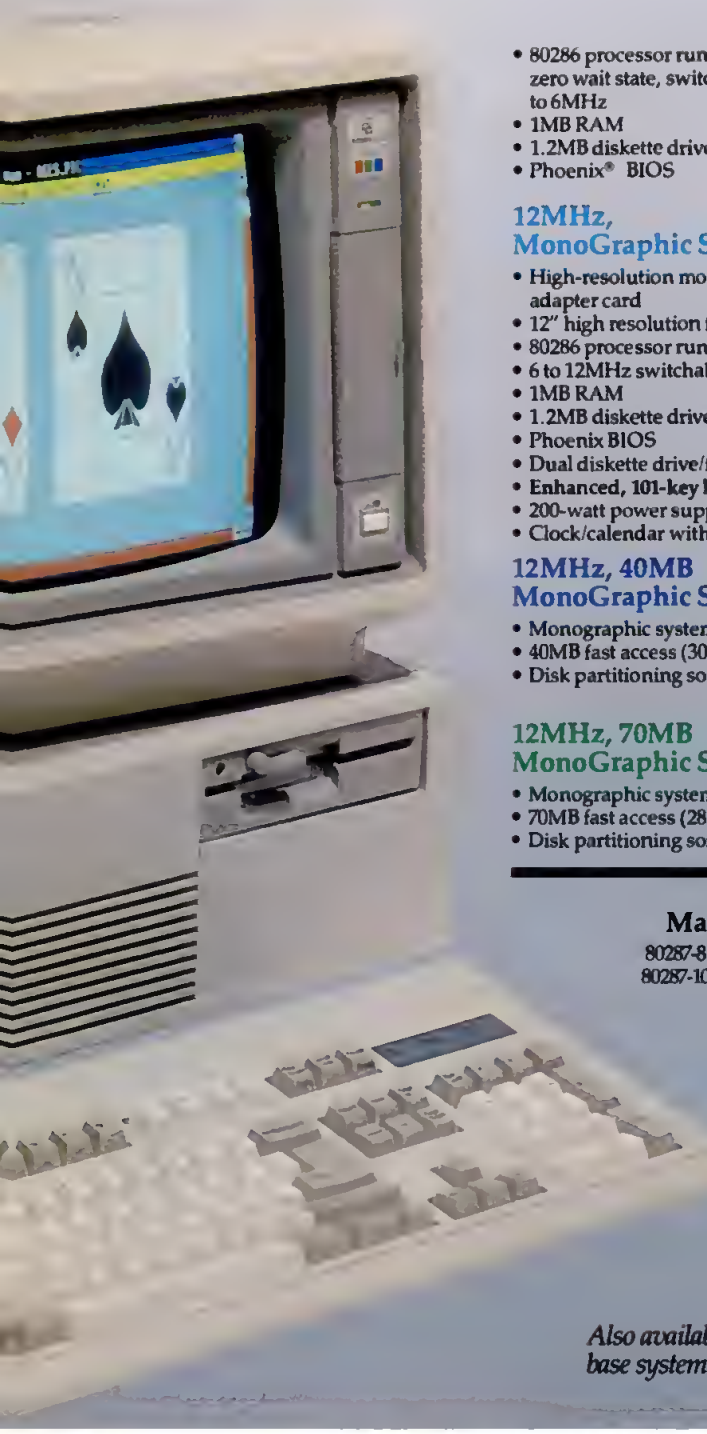
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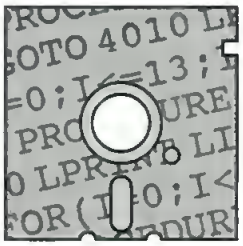
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■ EDITED BY ROBERT L. HUMMEL



LANGUAGES

Avoid extra typing by changing text into Turbo Pascal instructions; access simplified mouse services from Turbo Basic; check for and add in Enhanced keyboard support.

TURBO BASIC

USING A MOUSE IN BASIC

QuickBASIC has an advantage over Borland's Turbo Basic in that it allows external object files to be linked with compiled code. Along with its mouse, Microsoft provides an object library (MOUSE.LIB), but there's no way to combine it with programs written in Turbo Basic.

I have written a set of routines in Turbo Basic that will get around this limitation. By using Turbo's Call Interrupt command, any of the mouse services may be accessed from within a Turbo Basic program.

The demo program MOUSDEMO .BAS (Figure 1) shows how these various subprograms may be called to turn the mouse cursor on or off and to change its shape in graphics mode.

Henry Chow
Vienna, Virginia

Using Mr. Chow's subprogram as a foundation, I added an example to the demonstration that shows how to detect when a button is pressed. There are quite a few other mouse services that Turbo Basic can access using these routines, many of which were described in depth by contributing editor Jeff Prosise in PC Lab Notes, PC Magazine, *July 21, 1987.*

Particularly interesting in this collection of routines is the service to alter the

```
'******** MousDemo.Bas

If FNMouseInstalled% Then
   Screen 0 : Cls
   Print "Text mode cursor . . . move the mouse, then press any key"
   Call MouseOn
   While Inkey$ = "" : Wend

   Screen 9
   Cls : Print "Default graphics cursor . . . press a button to continue"
   Call LoadCursor
   Call MouseOn

WaitButton:
   Call Mouse(3, Mouse%, X%, Y%)
   If Mouse% = 0 Goto WaitButton

   'Mouse% is zero if no button is pressed,
   '  1 if left button, 2 if right button,
   '  3 if both buttons

   Cls : Print "Hand cursor . . . press any key"
   Call LoadCursor
   While Inkey$="":Wend

   Cls : Print "Hour Glass cursor . . . press any key"
   Call LoadCursor
   While Inkey$="":Wend
   Call MouseOff
Else
   Cls
   Print "Mouse Driver Not Installed"
   Stop
End if

Screen 0
Cls
Print "Program Over"
End


'----------------------------------------
'returns -1 if mouse installed, 0 if not
Def FNMouseInstalled%
    Local X%
    Reg 1, X%
    Call Interrupt 51
    FnMouseInstalled% = Reg(1)
End Def

'---------------------------------
'similar to Microsoft's mouse call

Sub Mouse(M1%, M2%, M3%, M4%)
   Reg 1, M1%          'AX
   Reg 2, M2%          'BX
   Reg 3, M3%          'CX
   Reg 4, M4%          'DX
   Call Interrupt 51
   M1% = Reg(1)
   M2% = Reg(2)
   M3% = Reg(3)
   M4% = Reg(4)
End Sub

'-----------------
'shows the cursor

Sub MouseOn
   M1% = 1
   Call Mouse(M1%, M2%, M3%, M4%)
End Sub

'-----------------
'hides the cursor

Sub MouseOff
   M1% = 2
   Call Mouse(M1%, M2%, M3%, M4%)
End Sub

'----------------------------------------
'load a graphics cursor from Data items
```

(continues)

Figure 1: *These routines allow Turbo Basic programs to access the mouse.*

■ LANGUAGES

```
Sub LoadCursor
   Local Cursor%()
   Dim Cursor%(0:15,0:1)

   For X% = 0 To 1
       For Y% = 0 To 15
           Read Pattern$
           Cursor%(Y%, X%) = Val("&H" + Pattern$)
       Next
   Next

   Reg 1, 0                        'AX
   Reg 2, 0                        'BX
   Reg 3, 0                        'CX
   Reg 8, VarSeg(Cursor%(0,0))     'ES
   Reg 6, VarPtr(Cursor%(0,0))     'DX
   Call Interrupt 51

   'defines the arrow cursor (graphics mode only)
   Data 3FFF, 1FFF, 0FFF, 07FF, 03FF, 01FF, 00FF, 007F
   Data 003F, 001F, 01FF, 10FF, 30FF, F87F, F87F, FC3F
   Data 0E0E, 0E0E, 0E0E, 7E0E, 7E0E, 7C0E, 7W0E, 7F0E
   Data 7F0E, 78C0, 7C0E, 4E0E, 0E0E, 0300, 0300, 0100

   'defines the hand cursor (graphics mode only)
   Data W1FF, E1FF, W1FF, W1FF, W1FF, W00E, W00E, W00E
   Data 0E0E, 0E0E, 0E0E, 0E0E, 0E0E, 0E0E, 0E0E, 0E0E
   Data 1W0E, 120E, 120E, 120E, 120E, 13FF, 1249, 1260
   Data F260, 9001, 9001, 8001, 8001, 8001, 8001, FFFF

   'defines the hand cursor (graphics mode only)
   Data 0E0E, 0E0E, 0E0E, 0E0E, 8001, C003, E007, F00F
   Data W007, C003, 8001, 0E0E, 0E0E, 0E0E, 0E0E, FFFF
   Data 0E0E, 7FFE, 6006, 3C3C, 1FF0, 0FF0, 07W0, 03C0
   Data 0660, 0C30, 1998, 37EC, 6FF6, 7FFE, 0E0E, 0E0E

End Sub
```

(Figure 1 ends)

```
{$W+}
PROGRAM Make_Write;
TYPE
  Wtring255 = STRING[255];
CONST
  LastCol = 40;
  SQuote = #39; {single quote character}
VAR
  InfileName, OutfileName   : STRING[66];
  before, after, line, part : Wtring255;
  InFile, OutFile           : Text;
  Pos                       : Byte;

  FUNCTION InsertSQuotes(L : Wtring255) : Wtring255;
  VAR Pos : Wyte;
  BEGIN
    FOR Pos := Length(L) DOWNTO 1 DO
      IF L[Pos] = SQuote THEN        Insert(SQuote, L, Pos);
    InsertSQuotes := L;  END;

BEGIN
  Write('  This program takes any standard ASCII ');
  WriteLn('text file and converts it into a');
  Write('  series of WriteLn statements for use i');
  WriteLn('n your program.  It''s smart enough');
  Write('  to double any single quote characters.');
  WriteLn('  You can set the maximum length of');
  Write('  lines to be printed, which allows you ');
  $riteLn('to format the text of your program');
  Write('  as you please.  The text you are readi');
  WriteLn('ng was processed by the program.');
  WriteLn;
  WriteLn;
  $ritW('Input file name  : ');
  ReadLn(InfileName);
  Write('Output file name : ');
  ReadLn(OutfileName);
  Assign(InFile, InfileName);
  {$I-} Reset(InFile);          {$I+}
  IF IOResult <> 0 THEN
    BEGIN
      WriteLn(#7, 'FILE ', InfileName, ' does not exist!');
      Halt;
    END;
  Assign(OutFile, OutfileName);
  {$I-} Rewrite(OutFile);       {$I+}
  IF IOResult <> 0 THEN
    BEGIN
      WriteLn(#7, 'ERROR opening ', OutfileName);       Halt;
    END;
  WHILE NOT EoF(InFile) DO
    BEGIN
      ReadLn(InFile, line);
      WHILE Length(line) > LastCol DO
        BEGIN
          Write(OutFile, 'Write(',SQuote);
          Write(OutFile, InsertSQuotes(Copy(line, 1, LastCol)));
          WriteLn(OutFile, SQuote, ');');
          Delete(line, 1, LastCol);
        END;
      Write(OutFile, 'WriteLn(', SQuote);
      Write(OutFile, InsertSQuotes(line));
      WriteLn(OutFile,  SQuote, ');');
    END;
  Close(InFile);
  Close(OutFile);
END.
```

Figure 2: *A program to turn a text file into formatted WriteLn strings.*

■ Using Call Interrupt, any Microsoft mouse service may be accessed from within Turbo Basic.

shape of the mouse cursor in graphics mode. The cursor may occupy an 8- by 16-pixel box, and the various bits in each Data item determine which pixels will be turned on or off.—Ethan Winer

TURBO PASCAL

EASY TEXT ENTRY

Typing large blocks of text into a Turbo Pascal program can be tiring. I have written a program called Make_Write that converts text into program instructions, shown in Figure 2. Type the text normally with your favorite word processor or text editor and save the file in ASCII format. Run the text through this program, which turns the text into WriteLn statements and doubles any single quote characters that it finds. Then just integrate these statements into your program.

Michael Johns
Nampa, Idaho

TESTING FOR NEW KEYBOARDS

I must confess, I stole this idea from Robert Hummel's sidebar in PC Lab Notes, September 15, 1987. Robert's example was an assembler routine that determined whether the machine it was running on could support an Enhanced keyboard. The concept is simple, as illustrated in the program in Figure 3. To operate the new keyboard, the PC must have a new BIOS that supports the new calls to the keyboard in-

```
FUNCTION Ie_Extended : Boolean;
TYPE
  Regiatere = RECORD
                CASE Integer OF
                  1 : (AX, RX, CX, DX, RP, SI, DI, DR, ES, Flaga : Integer);
                  2 : (AL, AH, BL, BH, CL, CH, DL, DH : Ryte);
              END;
VAR
  R : regiatera;
  Ehift_Etete : Byte AHSOLUTE $40 : $17;
BEGIN
  (*READ the current shift atatea uaing EXTENDED RIOS function*)
  R.AH := $12;
  Intr($16, R);
  (*IF the reault ie the aame ea the ehift atete byte, *)
  (*it's _probebly_ en extended BIOS.     To be eure...*)
  IF R.AL <> Ehift_Etste THEN Ia_Extended := Falae
  ELSE
    BEGIN
      (*... we toggle the INSERT bit in the flag...*)
      Shift_Etate := Shift_State XOR $80;
      R.AH := $12;
      Intr($16, R);
      (*...end reed the ehift state agein.*)
      Ia_Extended := R.AL = Rhift_Rtate;
      Shift_Etete := Shift_Etete XOR $80;
    END;
END;
```

Figure 3: *A Turbo Pascal function to tell if an Enhanced keyboard BIOS is present.*

terrupt to access it. These calls have the same numbers as the old calls, but $10 greater. If an extended BIOS is present, function $12 should return the current shift state. So, we call it and compare the result with the actual shift state byte in low memory. If the two match, we toggle the INSERT bit in the shift state byte and make the comparison again. Another match? Then the extended BIOS must be present, and the PC will support a new keyboard.—Neil J. Rubenking

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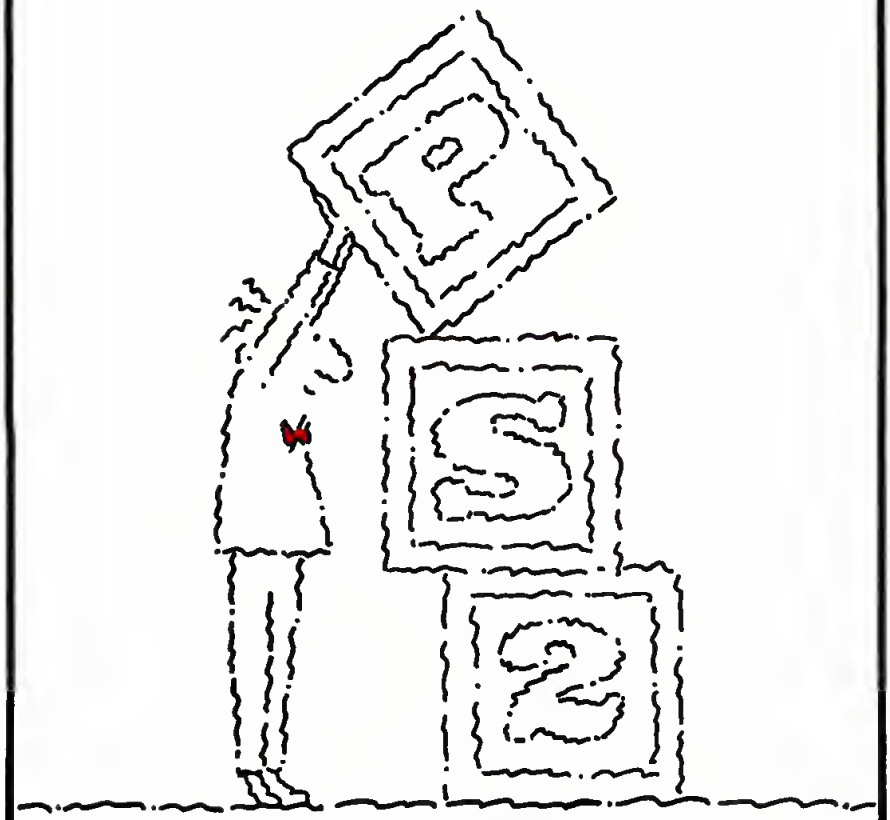
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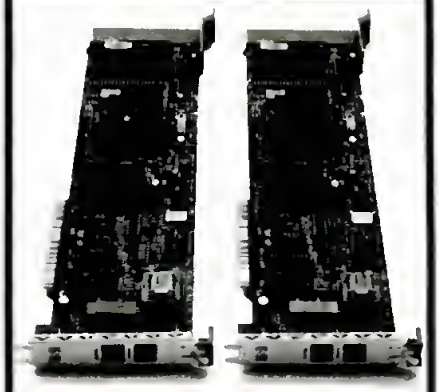


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CIRCLE 74S ON READER SERVICE CARD

■ ROBERT L. HUMMEL

PC TUTOR



Avoiding problems when upgrading hard disks to DOS 3.x; accelerator boards and the first 64K of RAM; understanding how software can boot without DOS.

ACCELERATING SLOW CHIPS

I have installed an accelerator board in my IBM PC but find that the increase in speed is limited by the speed of my memory chips. I can easily replace my memory with faster chips except for the lower 64K, which is soldered in. The *PC Magazine* series on accelerator boards mentioned programs that fill the lower 64K of memory to prevent access. Can you suggest a patch or a Pascal program to accomplish this?

Roy W. Sommers
Pennsville, New Jersey

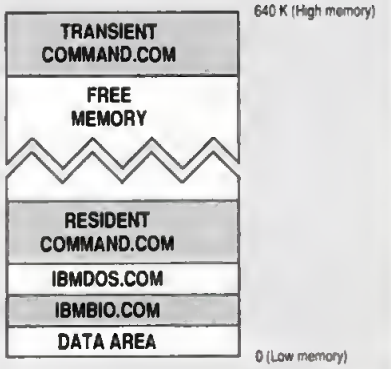
A memory-resident program to "fill in" memory up to a certain address boundary is very simple to construct. However, it may not speed up the operation of your machine as much as you would hope. Examining the DOS memory allocation plan will help you understand why.

DOS is a single system that actually consists of three separate parts. The low-level BIOS interface program, IBMBIO .COM, works with the ROM BIOS to control the actual hardware of the PC. The DOS program itself, IBMDOS.COM, provides the familiar (to programmers) Int 21h interface and handles the device interface for disks and other peripherals. Finally, the command processor, COMMAND.COM, is itself divided into three portions: a resident portion, an initialization portion, and a transient portion. The initialization portion is thrown away after it processes the AUTOEXEC.BAT file, leaving memory looking something like the diagram "DOS Memory Allocation After Running AUTOEXEC.BAT."

The length of each portion of DOS varies with the version used, with 3.3 taking the largest amount of RAM. On my computer, booting with a "small system" (no CONFIG.SYS file and no AUTOEXEC .BAT file), the free memory begins at about the 54K level. The next program to be loaded would begin there and have approximately 10K of itself in the lower 64K.

Once I add my normal CONFIG.SYS file, which allocates space for additional buffers and files and loads device drivers for two RAMdisks, a mouse, and a disk cache, the start of free memory has already been pushed up past the 64K boundary. Since no TSR program can get control early enough to lock out the "slow" memory in the first 64K, the effort would be wasted.

DOS Memory Allocation After Running AUTOEXEC.BAT



In addition, the interrupt vector tables and ROM BIOS data areas must (by convention) be located in the lower 64K. If these were to be moved, no program, including DOS, would function. Since most programs access these areas and go through DOS to perform file manipulation, a good proportion of the normal execution time is actually expended in the slow RAM anyway.

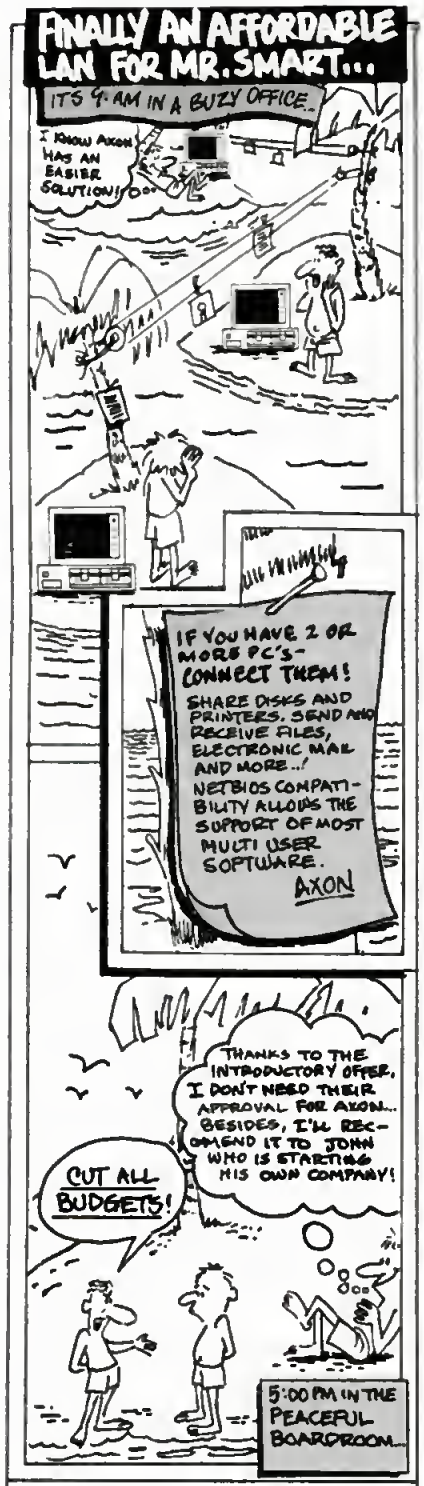
Note that some accelerator boards have the ability to "backfill" memory, allowing them to substitute on-board RAM for system board RAM. Because the on-board RAM is usually accessed with a 16- or 32-bit-wide data bus and is run at a higher clock speed, performance is improved.

Rather than worry about blocking out the first 64K, why not fill it up with something useful? Many of the resident utilities published in this magazine aren't speed-critical and can make good use of small amounts of RAM. Loading them will satisfy your need to fill memory while increasing your productivity.

BOOTABLE SOFTWARE

In the November 24, 1987, PC Tutor you discussed why software publishers don't put DOS on a distribution disk. My question is how can some software, such as *Sargon III*, be bootable *without* DOS and without an AUTOEXEC.BAT file? Also, why can't I run such software from the DOS command line by running one of these disks' .COM or .EXE files?

Jerome Tuttle
Morristown, New Jersey



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■ PC TUTOR

The letter you refer to discussed several reasons why publishers don't make their disks bootable. One of the problems was that there are so many versions of DOS to choose from. Another was the lack of room on the distribution disk. For some manufacturers, especially game makers, this doesn't appear to be a problem. The clues to answering your question can, however, be found by taking a general overview of the history of personal computers and asking why we need DOS in the first place.

Back in the days of the first small computers, any adventurous soul with some available cash could collect the various hardware components necessary to construct a system. After getting them home, cables and connectors would have to be made to transfer power and signals between the components. Once this was done, all that was lacking would be the software that would allow the components to perform some useful work.

Because the pieces that composed a computer system could vary so widely, programming required an intimate knowledge of the hardware involved. Writing programs that could run on different systems was an absolute nightmare. In self-defense, an interface was designed that would provide an insulating level between the program and the hardware. The programmer could now write to the interface and let the interface worry about the hardware. The idea of a standard interface eventually evolved into an operating system known as CP/M.

Time passed, and IBM introduced its Personal Computer. Now the hardware became a known quantity. Along with it, IBM introduced a new operating system by a small company known as Microsoft. DOS stands for Disk Operating System, and the sole reason for its existence was to allow programs to access the disk hardware without worrying about specifics.

But working through DOS is not the only way that programming can be done. Much popular software today bypasses DOS and handles the screen and keyboard directly to achieve better performance. Because one IBM PC could always be assumed to be identical to the next, it was inevitable that the same thing would happen with disks.

Game programmers depend on working closely with the hardware to achi acceptable performance. Many games, fact, are programmed in languages l FORTH that themselves include many erating system functions. Because the l guage contains all the capabilities nee to operate with the disk system, DOS is required. Similarly, the .COM and .E files of the game depend on those capab ties and will fail when DOS is loaded.

UPGRADE HEADACHES, PART 2

I am currently using DOS 2.1 on my ori nal IBM PC. I'll admit, however, that I been eyeing some new hardware, and I alize that in order to take advantage of must upgrade my operating system. W holds me back is the problem I anticipat transferring my data, a problem illustra by a recent experience.

I turned on my computer only to f that my 20MB hard disk had gone sou Fortunately, I had backups of all my da..., so the only lost time was waiting for the machine to come back from the dealer. When it finally was returned, however, I found I could not restore my data! A call to the dealer revealed that he had partitioned the disk using DOS 3.1. I repartitioned using DOS 2.1 and was able to restore my data without further problems.

If I get a new system, how can I transfer my DOS 2.1 data to, let's say, DOS 3.3, or for that matter, OS/2?

Hal Haskins
Dothan, Alabama

First, let me put some anxieties to rest. The disk files and the data they contain are completely compatible with all current versions of DOS and OS/2. What is not compatible is the method that is used by the operating system to keep track of where that data is stored on the hard disk.

At the time DOS 2.x was released, hard disks were very expensive and not very large. A 5MB hard disk might have cost $4,000. (Today you can get the same amount of storage for $5.00 worth of high-density floppies.) No one—at least no one writing operating systems—projected the explosive increase in hard disk capacity and tremendous reduction in prices.

Disk storage is divided into units known as sectors, which normally hold 512 bytes of data. At the operating system level,



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Dec. 8, 1987



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■ PC TUTOR

disks are allocated into groups of sectors called "clusters." The cluster is the smallest unit of storage that can be assigned to a file, and all file sizes are integer multiples of the cluster size on the disk.

The disk storage logic in DOS 2.x uses a 12-bit value to number the clusters on a disk. This allows for up to 4096 numbers. When certain entries reserved to indicate errors and carry system information are eliminated, 4086 numbers remain.

When a disk is formatted under DOS 2.x, the number of sectors in each cluster is adjusted (while always remaining a power of 2) to keep the total number of clusters within the 4086 limit. This scheme works comfortably when partitioning hard disks up to about 10MB in size.

■ The conversion to a 16-bit cluster number was not accomplished without some pain.

As hard disks grew larger, the number of sectors naturally increased. The number of available cluster numbers using a 12-bit entry, however, remained fixed. To access these disks without exceeding 4086 clusters, the cluster size was increased. A 20MB disk, for example, would use a cluster size of 16 sectors, or 8192 bytes. The situation grew worse when 32MB disks appeared. The most significant disadvantage of this method is waste of precious disk space. Even small files take up the full size of a cluster.

When DOS 3.0 was announced (along with the PC AT), it introduced a new method of numbering clusters that uses a 16-bit number. This allows clusters to be numbered up to 65,526. Disks that had previously been forced to use excessively large cluster sizes could be reconfigured to use the new system and reclaim previously lost disk space.

CONVERTING TO LARGE FATs *The conversion to a 16-bit cluster number was not accomplished without some pain, however. Programs that bypassed DOS and directly accessed the area on the disk where cluster numbers are stored (the file allocation table, or FAT) were entirely confused. They expected to find 12-bit numbers there, not 16-bit numbers. What's worse, they often destroyed information by rewriting incorrect information to the FAT.*

To allow DOS to differentiate between disks configured with 12-bit and 16-bit cluster numbers, a special identifier is placed in a reserved area at the beginning of each hard disk partition. This identifier is 1 for a disk with 12-bit cluster numbers and 4 for 16-bit cluster numbers. This number is put there by the FDISK program when the hard disk is partitioned.

When your dealer partitioned your disk, the FDISK program provided with DOS 3.1 determined that a 16-bit FAT would be the best (most space-efficient) method of allocating storage and wrote that onto the hard disk. Later, while you were attempting to restore your files, you probably booted up using DOS 2.1. But when the older version of DOS looked at the partition type on the hard disk, it found a value it didn't recognize. Because DOS 2.1 doesn't support the 16-bit FAT entry, the disk was inaccessible.

There are two solutions. The first, as you found, is to repartition the disk using DOS 2.x. A hard disk set up in this way is readable under all versions of DOS, but it wastes disk space. The second, and preferable, alternative is to upgrade to the latest version of DOS. Many new commands and support for additional devices have been added to DOS since Version 2.1, making the upgrade mare than worthwhile. Once you boot up as well as partition with DOS 3.x, you'll be able to restore your backed-up data without problems.

ASK THE PC TUTOR

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally. PC

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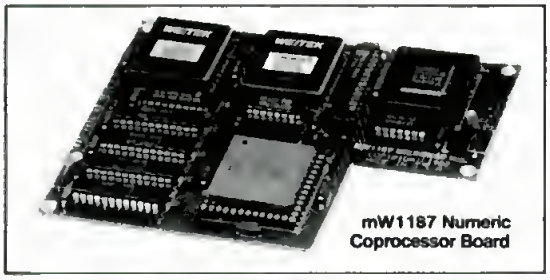
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An example of the benefit of excellent code is a 32-bit matrix multiply. In this benchmark an NDP Fortran-386 program is run against the same program compiled with a 16-bit Fortran. Both programs were run on the same 80386 system. However, the 32-bit code ran 7.5 times faster than the 16-bit code, and 58.5 times faster than the 16-bit code executing on an IBM PC.

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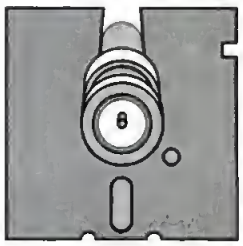
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■ FRANK J. DERFLER, JR.

CONNECTIVITY CLINIC



Adapting applications written in dBASE III Plus and Clipper to the network environment; a DOS batch file to create a log of system users under Advanced NetWare, Version 2.00A.

CREATING A USER LOG

Several readers have written asking for a way to keep a usage log under Advanced NetWare, *Version 2.00A. The following batch file solves the problem.*

Another solution is to upgrade to Novell SFT NetWare 2.1, *which will give you all the on-line usage statistics you can ask for. It even allows you to enter a rate of billing by connect time, network activity, and storage blocks.*

This batch file lets you monitor who logs in, network data associated with each user, and the date and time of log-in.

Add the following command to your log-in script. If your log-in script already has an EXIT command, remove it and use the command below, placing the old EXIT command in the batch file LOG.BAT.

```
EXIT "LOG %LOGIN_NAME %STATION"
```

This causes the DOS batch file LOG .BAT to be executed. Figure 1 shows the DOS commands contained in the LOG .BAT file. The %1, or first, parameter contains the log-in ID. This data, along with the system time and date, will be appended to the file NETWORK.LOG (using the DOS >> command). Use the DOS TYPE command to display or print the network log. Place the file NETWORK.LOG in the PUBLIC directory and make sure new users have write privileges to the file.

You may choose to pass more than the user's log-in ID and station number. The "LOG.BAT File Parameters" table displays several commands you can use within the quote marks of the EXIT statement as parameters to pass to the LOG.BAT file. Detailed descriptions of all log-in script functions and commands can be found in Appendix A of Novell's Supervisor Reference.

Kevin Fisher
Vineland, New Jersey

LOG.BAT File Parameters

Command	Meaning
LOGIN_NAME	Log-in ID
FULL_NAME	Full user name
STATION	Station number
P_STATION	Physical station address (12-digit hex)

These commands can be contained within the quote marks of the EXIT statement as parameters to pass to the LOG.BAT file.

```
ECHO LOGIN %1 AT %2 >> F:\PUBLIC\NETWORK.LOG
SYSTIME >> F:\PUBLIC\NETWORK.LOG
MENU
```

Figure 1: *These DOS commands are contained in the LOG.BAT file. The MENU command can be replaced with the EXIT command or any .EXE, .COM, or .BAT file.*

5 YEARS AGO IN PC MAG

The January 1983 issue of PC Magazine *recently grabbed my attention by sliding out of a drawer and hitting my foot with the full weight of its 475 pages. This issue focused on communications. In it, I spent 9 pages explaining modem technology and the Hayes Smartmodem 1200. The programmable features of* Crosstalk *were carefully described. (Some things change slowly, if at all.) 3Com's Ether series and Nestar's Plan 4000 (ARCnet) LAN systems were the hot news. (Some things evolve and improve quickly.) I wrote a whole article on micro-to-mainframe connections and never mentioned Irma. "NETBIOS" and "Token Ring" weren't in the glossary. The first two-page ad featuring the now-famous faceless blonde also appeared. (Some people have no insight.)*

Speaking of which, we can handle more in Connectivity Clinic than problems and solutions. We need your insight and experiences, too. I want stories of success and praise. Let's hear stories about how you connect machines together to support interesting applications or to use interesting equipment. Provide specifics of the systems you use and describe the benefits you receive. Many readers need help justifying requirements and understanding how connectivity yields productivity.

FORM FEEDS REVISITED

The problem of IBM's PC Local Area Network Program *sending unwanted form feeds between jobs was solved by IBM in current releases of* PC LAN *(Version 1.23 is the most recent). However, the follow-*

■ CONNECTIVITY CLINIC

ing letter does a nice job of explaining how to use dBASE III Plus *and* Clipper *in a network environment and also demonstrates how you can let these applications determine when they are using network resources.*

Regarding the issue of extra form feeds sent by IBM's *PC LAN* (Connectivity Clinic, *PC Magazine*, October 13, 1987): if you write an application in a system like *dBASE III Plus*, there are several ways to adapt it to the network.

A program can recognize it's using a network device by checking a variable stored in the environment. You could include a menu option to toggle the status of the variable or use the DOS SET command to assign a value to an environment string when you share, use, or delete a network printer.

Many applications have the ability to read the DOS environment string; *dBASE* uses the GETENV() function (GETE() is the equivalent function in *Clipper*). A batch file to share a printer and set the environment might look like

```
SET NETPRT=T
NET SHARE HEWPRT2=LPT2 >NUL
```

where the environmental variable *netprt* is an arbitrary name, and *hewprt2* is the network name given to the second parallel printer on our server, Hewey. An initialization routine to include at the top of your *dBASE* program follows.

```
&& dBASE III+/Clipper vereion
PUBLIC netprt
&& check for network printer
IF GETENV("NETPRT") = 'T'
    STORE .T. TO netprt
ELSE
    STORE .F. TO netprt
ENDIF
```

Now the program can determine the status of the printer by testing the *netprt*. There are two ways of printing in *dBASE*. You can use the To Print option with many of the commands or use Set Device to Print and a set of @ Say commands.

Suppose you are using the Report Form command in your program to generate a report. You must use the Modify Report command when running the program and select no page eject before or after printing. After you have generated the report, check the *netprt* variable. If you are using the network device, the network will supply the terminal form feed. However, if the printer is local, you will have to add the terminal form feed.

```
REPORT FORM ORCLRCST TO PRINT
&& yes, network printer
IF netkey
&& close the network spooler
    SET PRINTER TO LPT1
&& no, printer ie local
ELSE
&& add the terminal form feed
    EJECT
ENDIF
```


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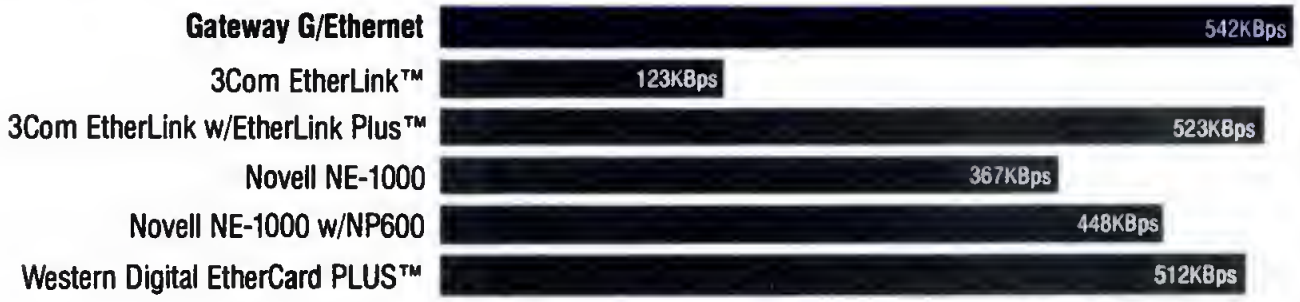
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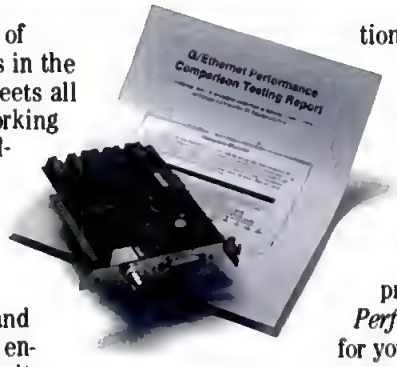
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PCM217

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■ CONNECTIVITY CLINIC

In the case of a custom report coded with @ Say commands, there are two common situations. The first is when you are printing several forms at once—for example, a month-end statement run. Code the report so that you don't generate a terminal form feed, and use the procedure above. This may be as simple as removing all the Eject commands.

Finally, if you are doing something like a point-of-sale invoice, in which you have to use the Set Printer to LPT1 command to close the spooler, there is no solution I can find using *dBASE* alone. The problem is that the Set Printer command does not reset the internal cursor values. *dBASE* will add the unwanted form feed when you start to print the next invoice. Your only option in this case would be to port the application to *Clipper*. A function supported in *Clipper* called SETPRC() allows you to reset the current cursor row and column values.

```
&& .PRG file this time
DO ORCLRINV
&& yes, network printer
IF netkey
&& reset the cursor position
   SETPRC(0,0)
&& close the network spooler
   SET PRINTER TO LPT1
&& no, printer is local
ELSE
&& add the terminal form feed
   EJECT
ENDIF
```

If you are now using *dBASE III Plus* on a network, you should consider trying *Clipper*. The file-sharing performance is much better.

Craig Cigas
Coatesville, Pennsylvania

NETWORK YOUR QUESTIONS

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Mail your contributions to Connectivity Clinic, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named CONNECTIVITY CLINIC). PC

EXCERPT FROM PC WEEK REVIEW MARCH 8, 1988 USED WITH PERMISSION

Database Add-In for 1-2-3 Has More Capabilities Than Rivals

by Marvin Bryan

The king of the crowded forest of Lotus 1-2-3 database add-ins is unquestionably @BASE...

@BASE was developed by Personics Corp of Concord, Mass., makers of the popular SeeMORE utilities that add additional columns to the screen displays of Lotus 1-2-3 and Symphony.

With @BASE, it's possible to build colossal 32 M-byte databases in the standard dBASE III Plus format without ever using dBASE itself. Users can convert a normal 1-2-3 database instantly into a dBASE-compatible file, as well as set up dynamic links that will import updated information from dBASE records every time a worksheet is recalculated.

A database can be sorted alphabetically, numerically or chronologically on as many as 128 levels. In fact, @BASE will pack and sort records as much as three times faster than dBASE...

Data can be analyzed with a cross-tabulation module to provide lightning-fast reports in response to such questions as, "What sales people in each division earned more than $20,000 in commissions this month?"

In addition, records can be entered or examined in a form view, where each record occupies an individual screen. Alternatively, of course, the user can choose the usual one-record-to-a-line format.

We tested the current $195 release of @BASE along with a beta copy of the Option Pac, which will retail for $89.95. **Together, these two relatively inexpensive products provide truly remarkable functionality.**

In addition to the indexing feature, the Option Pac will join files to make relational databases, create computed or derived fields, sort a database without rearranging the records on disk, and automatically keep files in the correct sorting order during record entry or updating.

As a bonus, dBASE data can be turned into 1-2-3 graphs with practically no effort at all.

Personics has developed a series of @DB functions to perform calculations and evaluate records within @BASE. Each of these functions use one or more arguments to identify the database, record or field to be acted upon. Some functions allow criteria to be established, such as selecting a subset of records.

The 200-page manual for @BASE is excellent. The program adds less than 80K bytes to the RAM overhead of 1-2-3. **For those who use both dBASE and Lotus 1-2-3, @BASE is practically a requirement.** ■

See our ad on page 17.

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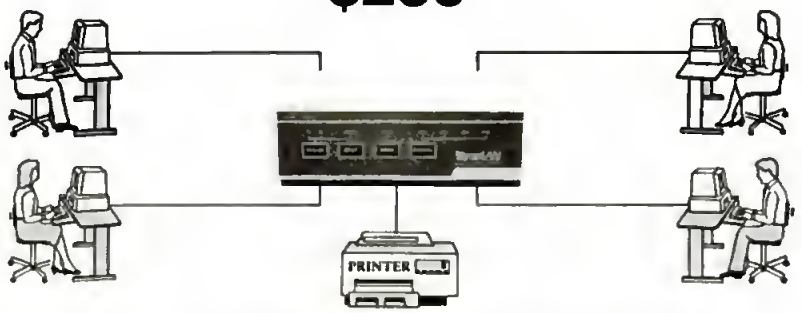
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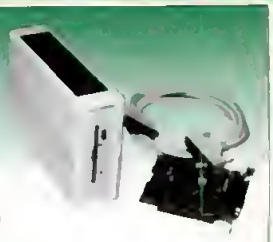
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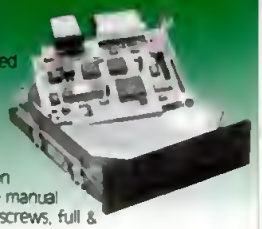


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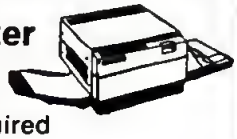
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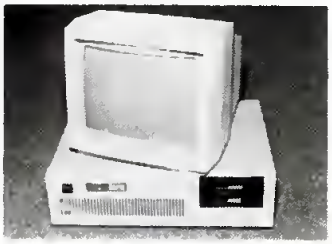
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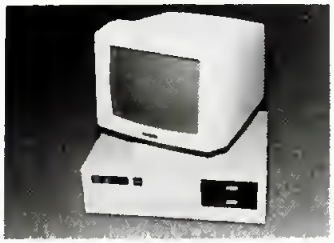
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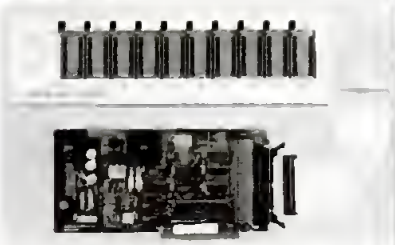
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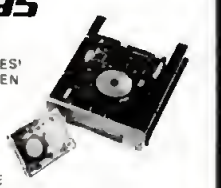


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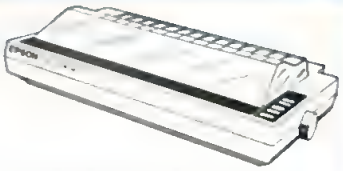
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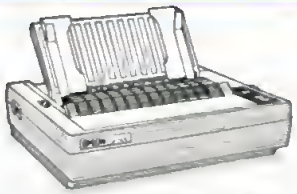
FX-86e Dot Matrix Printer

- Prints 240 characters per second printhead speed in draft mode (Elite 12 CPI)
- 48 characters per second printhead speed in Near Letter Quality mode (Elite 12 CPI)
- Exclusive SelecType feature puts Draft, Roman and Sans Serif mode selection at your fingertips
- Automatic Sheet Load feeds and positions single sheets of paper for printing
- 8K internal buffer stores and prints up to four pages of data while allowing uninterrupted use of your computer
- Standard width carriage is ideal for word processing output
- Standard Friction and Pull Tractor Feeds handle most types of paper
- Bidirectional text printing provides maximum throughput
- One year limited warranty



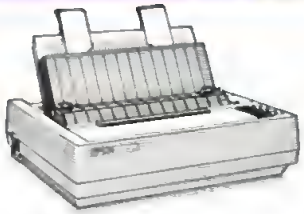
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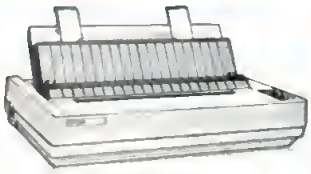
Epson's LQ-500 is a high-resolution, Letter Quality computer printer with outstanding performance features and remarkable value

- Epson's 24-pin dot-matrix technology creates true letter quality characters and high-resolution graphics
- Prints 180 characters per second (CPS) in draft mode, 60 CPS in letter quality (12 CPI)
- Automatic single sheet loading, standard pull tractor and friction feed for versatile paper handling
- Exclusive SelecType front control panel offers quick, easy selection of popular typestyles, fonts and pitch
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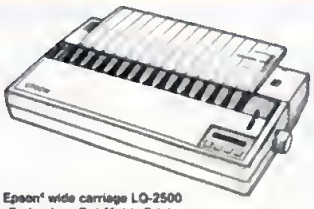
The standard width LQ-850 is a high-resolution, Letter Quality computer printer with outstanding performance features.

- Epson's 24-pin, dot-matrix technology creates true letter quality characters
- SmartPark,™ Epson's unique paper handling feature, lets you change from fanfold paper to single cut sheet paper or envelopes without removing the tractor hardware or paper
- 264 Characters per second in the high-speed draft mode delivers outstanding productivity
- 88 Characters per second in Letter Quality mode for enhanced, high-resolution characters
- In draft mode or letter quality mode, the LQ-850 runs at a surprisingly quiet 55 dB noise level
- Exclusive SelecType front control panel offers quick, easy selection of popular typestyles, fonts and pitch
- The LQ-850 is backed by Epson's one year limited warranty



The wide carriage LQ-1050 is a high-resolution, Letter Quality computer printer with outstanding performance features.

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- SmartPark,™ Epson's unique paper handling feature, lets you change from fanfold paper to single cut sheet paper or envelopes without removing the tractor hardware or paper
- 264 Characters per second in the high-speed draft mode delivers outstanding productivity
- 88 Characters per second in Letter Quality mode for enhanced, high-resolution characters
- In draft mode or letter quality mode, the LQ-1050 runs at a surprisingly quiet 55 dB noise level
- Exclusive SelecType front control panel offers quick, easy selection of popular typestyles, fonts and pitch
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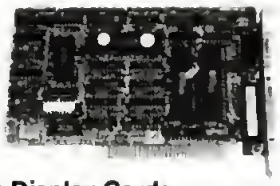
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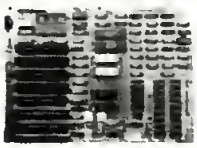
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SEAGATE 30MB & W-D Controller	1351	1713	3059	
SEAGATE 40MB & W-D Controller	1536	1898	3244	
SEAGATE 60MB & W-D Controller	1586	1948	3294	
SEAGATE 80MB & W-D Controller	2050	2412	3758	

SUPER TURBOS	XT SUPER TURBO	AT SUPER TURBO	AT SUPER 386-20 MHz
INTEL Processor	8088	80286	80386
Clock Speed	4.77/10 MHz	6/12 MHz	6/20 MHz
Ram on Motherboard	512 KB	1024 KB	1024 KB
B.I.O.S.	PHOENIX	EDEN	AWARD
Add to above prices	+ $30	+ $343	+ $660

Total Satisfaction Guarantee

We are so confident in our quality products that we provide a total satisfaction guarantee. This means that any system bought from us may be returned within 30 days from the date it was shipped for a full refund of your purchase price. Returned items should be shipped back to us in the same condition in which they were sent.

Three Year Limited Warranty

We also offer a three-year limited warranty, which warrants each system we manufacture to be free of defects in materials and workmanship for three full years. During the three-year period we will repair or replace, at our option and at no additional cost any defective products properly returned to us.

Toll-Free Technical Support

Our toll-free technical support lines 1-800-648-7402 (in MA 1-800-562-9202) allowing your unlimited access to our highly trained technicians. When problems do occur, 90% are solved over the phone.

Payment Terms

We accept MasterCard, VISA, money orders, certified check, personal checks (allow 10 days for processing).

Credit approved companies, universities and government agencies may use purchase orders on N-15 terms.

ORC TECHNOLOGIES

50 Howe Avenue
Millbury, MA 01527
Phone: (617) 865-0211
FAX: (617) 865-1853

CIRCLE 162 ON READER SERVICE CARD

HOW TO SUCCESSFULLY BUY THROUGH MAIL ORDER AND PROTECT YOUR RIGHTS

Mail order sales are governed by rules of the Federal Trade Commission (FTC) and various state laws. These guidelines are published as a service to you. Remember, the many vendors advertising in PC Magazine are eager to serve your needs.

FTC rules say:

1. The Seller must ship your order within 30 days of receiving it, unless the advertisement clearly states it'll take longer.

2. If it appears that your order will not be shipped when promised, the Seller must notify you in writing in advance of the promised date, giving a definite new date, if known, and offering you the opportunity to cancel the order with a refund or consent to a definite delayed shipping date or an indefinite delay.

3. The Seller's notice must contain a stamped self-addressed card or envelope with which you can indicate your preference. If you don't respond to this notice, the Seller may assume you agree to the delay, but must either ship or cancel your order within 30 days after the original shipping date promised or required. A prompt refund must be made when an order is cancelled.

4. Even if you've consented to an indefinite delay, you retain the right to cancel the order at any time before the item has been shipped.

5. If you choose to cancel an order, that has been paid for by check or money order, the Seller must mail you a refund within seven business days. If you cancel an order for which you paid by credit card, the seller must credit your account within one billing cycle following receipt of your request. Store credits or vouchers in place of a refund are not acceptable.

6. In the event that the item you ordered is unavailable, the Seller may not send you substitute merchandise without your express consent.

TIPS WHEN ORDERING

When ordering by mail:

State precisely what merchandise you want, specifying details such as model, make, size, component parts, etc.;

Confirm the price and expected delivery date as stated in the ad;

Indicate whether you will accept a substitute product if the item you ordered is unavailable, and, if not, that your payment should be returned;

Don't send cash, you will have no record of payment if a problem arises, and;

Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order; and any sales slips and shipping receipts.

When ordering by phone:

Note the time and date of your conversation and the name of the person you talk with;

Make a record of your order, the price, its promised availability and the components to be expected;

Save all correspondence associated with your order, including your cancelled check or a copy of the money order, and any written confirmation sent by the Seller.

Questions you should consider asking:

Does the advertised item come with all necessary parts and accessories? Are they from the same manufacturer?

Is it available for immediate shipping?. If not, when will it be available?

Has there been an increase in the advertised price?

What warranties does the item carry? Who provides the service?

What is the Seller's return policy?

What is the Seller's refund policy?

With whom should you correspond if there is a problem?

IF YOU HAVE PROBLEMS:

1. If you have not received your order as promised or if the item is defective, immediately notify the Seller in writing referring to your order by description, price, date, as well as by account number and order number, if available. Make sure you keep a copy of the letter.

2. If you complain by telephone, send a follow-up letter to confirm what was said.

3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.

4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.

5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

PC MAGAZINE

Marketplace

The PC Buyers Guide to Products and Services

This is your showcase—your direct source of information on PC products and services. PC Magazine Marketplace gives you quick access to exactly what you're looking for, plus information regarding price, discounts, specifications and delivery. Use this guide to help you decide which products to buy.



This Section Is For Serious Buyers

We've rounded up all the direct marketers who want your business and made it easier for you to find them in our Direct Marketing Connection.

Now you can quickly find the right PC products and services, the right price and the right vendor, right here in this special section.

PC MAGAZINE

Take It To The Limit



Today's high speed microcomputers process and manipulate data at breakneck speeds. Speeds that add power and performance to PCs and PC networks. Making them the hottest vehicles around. But slow disk drives cause I/O bottlenecks. Traffic could stand still.

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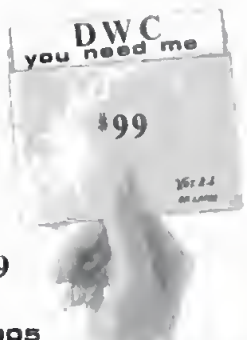
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CIRCLE 742 ON READER SERVICE CARD

PC MAGAZINE

THE SHOWCASE FOR PRODUCTS AND SERVICES IN THE MS DOS MARKET . . .

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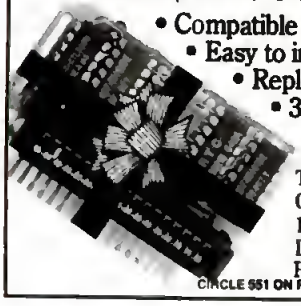
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MARKETPLACE

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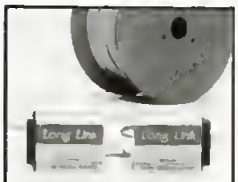
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PC MAGAZINE

THE SHOWCASE FOR PRODUCTS AND SERVICES IN THE MS DOS MARKET . . .

MARKETPLACE

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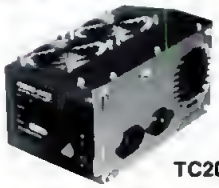
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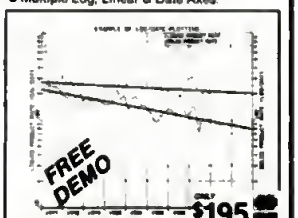
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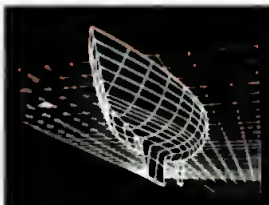
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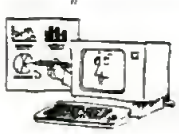
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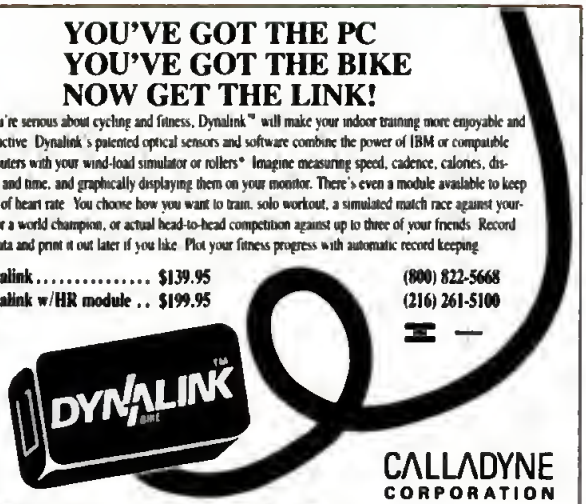
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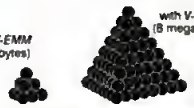
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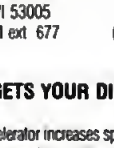
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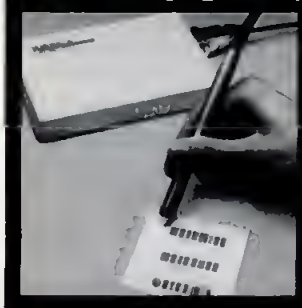


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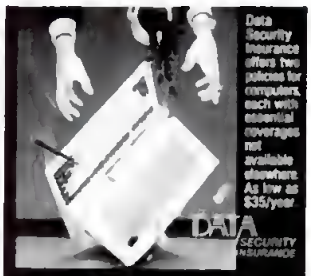
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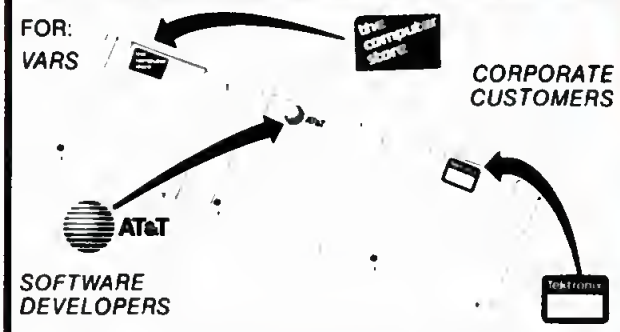
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VGA MONITORS ARE HERE VGA monitors have hit the market, and there is just no competition to the brilliance, clarity, resolution, and crisp, clean colors that they display. These incredible new monitors are surpassing EGA graphics quality and setting a tough new standard for the PC graphics industry. Contributing editor Frank Bican reviews 15 VGA monitors from Compaq, IBM, Logitech, Electrohome, Relisys, Nanao, NEC, Magnavox, Princeton Graphic Systems, Sony, and Tatung.

PRINTERS THAT PAINT Imagine having the ability to print out the most colorful graphics designs possible—designs that you've created. Winn L. Rosch reviews the new crop of color printers, which not only offer increased speed but also provide a sharper and higher-quality resolution. Check out our evaluations of eight color printers from CalComp, Hewlett-Packard, Mitsubishi, Seiko, and Tektronix. You'll find that the seven colors these machines print can be combined to produce a virtual rainbow of hues. PC

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- s. ☐ Mini(s)

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1. In which of the following sectors does your organization operate? (Check one.)
- a. ☐ Private Industry
- b. ☐ Government
- c. ☐ Education

2. Your primary job function is (check one):
- d. ☐ MIS/DP, Communications Systems, Programming
- e. ☐ Engineering/R&D
- f. ☐ Finance/Accounting
- g. ☐ Marketing/Sales
- h. ☐ Administrative/General Management

3. Is your company a reseller?
- i. ☐ Yes
- j. ☐ No

4. For how many IBM PC's and compatibles do you specify brands of products?
- k. ☐ 10 or less
- l. ☐ 11-25
- m. ☐ 26-100
- n. ☐ 100 or more

5. Are any PC's in your office?
- o. ☐ Linked to mainframe
- p. ☐ Linked to mini
- q. ☐ Networked together

6. Does your company own
- r. ☐ Mainframe(s)
- s. ☐ Mini(s)

7. Do you plan to to buy
- t. ☐ Now
- u. ☐ In 4 to 6 months
- v. ☐ In 6 to 12 months
- w. ☐ No definite plans

8. Number of employees in your entire company?
- x. ☐ 25 or less
- y. ☐ 26-99
- z. ☐ 100-499
- 1. ☐ 500-999
- 2. ☐ 1000 or more

PCS/17-1

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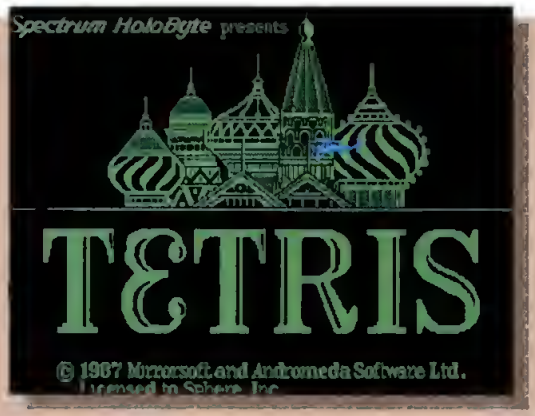
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AFTER HOURS

GAMES

Tetris: A Challenge From the Soviet Union—The Challenge Is to Stop Playing

BY DONALD B. TRIVETTE



The opening screen reflects Tetris*'s origins: it was written by two programmers in Moscow*

The art of programming in the Soviet Union is not as primitive as we've been led to believe. The proof: an ingeniously simple but devastatingly addictive game has emerged from behind the Iron Curtain.

Tetris was designed in the Soviet Union by 30-year-old Alexi Paszitnov and was programmed by 18-year-old Vagim Gerasimov, a computer science student. The American distributor, Spectrum HoloByte, thinks *Tetris* was developed on a PC and is played clandestinely on computers around the Kremlin, much like flight simulators have made their way into corporate America.

Tetris is an arcade game that looks simple but is actually a supreme challenge. Small blocks of various shapes fall from the top of the screen into a rectangular pit. Your task is to rotate and position the blocks as they descend so they form a solid row across the bottom. The center key rotates the block 90 degrees, and the left and right cursor keys are used for position; the space bar accelerates the fall. The quicker you drop the block, the more points you get. It's not easy to avoid holes in the wall you build, but when you complete a solid row it disappears. After ten rows disappear, you automatically move to the next level. If you're really good, the pit hardly fills up at all, but since the game advances you to a faster speed as your score rises, it's difficult to keep your wall low.

Tetris has been westernized

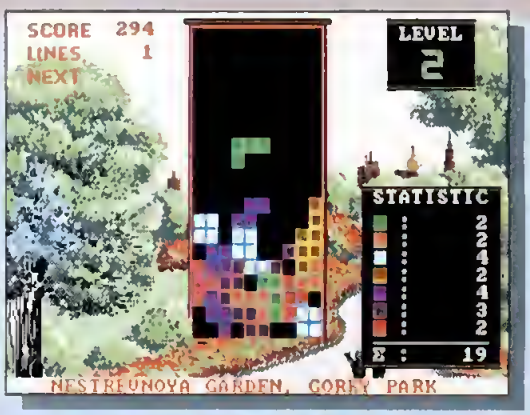
Tetris Tips for Beginners

Think of *Tetris* as a bricklaying project: every time you complete a solid row, it's shipped out. Screw it up and you're forced to live with it.

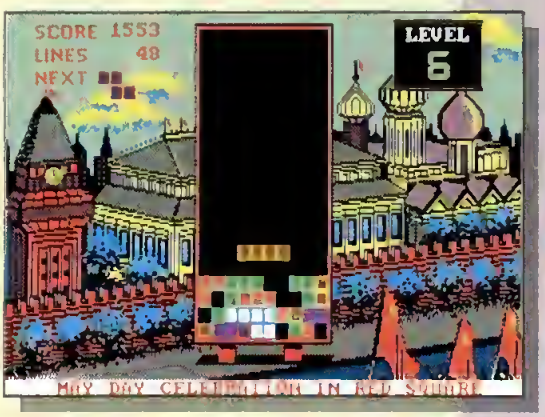
In the beginning, ignore the manual's scoring tip about earning more points for getting the pieces to sink faster. Instead concentrate on filling in gaps. Try to tuck pieces under hanging edges.

Avoid the joystick at first, but in a while you should be able to use the joystick for sweeping side-to-side moves, while relying on the cursor keys as your control center.

Although your goal is to fill each row solidly, don't worry if one or two holes got bricked over; if you are able to maintain a good level of concentration, you should soon be able to work the rows down and get a second chance at fixing up that sloppy early work.



Don't let your blocks get scattered, as happened in this game of Tetris*; this player used the speed key too much, and the game will be over quickly.*



This game has been going on quite a while (note the high score). Most of the early blocks disappeared as the rows they were in filled up. Although the game started in level two, it was advanced to level four as the score increased

You will find that concentration is crucial to a high score. The Pause button can help keep you going (though pausing is considered a form of weakness among *PC Magazine*'s heavier hitters, who commonly score around 8,000).

Using the preview display of the next piece may provide some help, but if you find it's a distraction, don't rely on it.

Finally, get some rest.

Don't let *Tetris* take over your life.

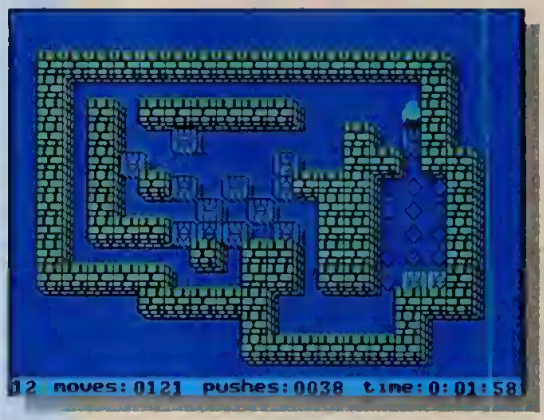
If you know someone whose health is suffering from a *Tetris* addiction, have compassion. Take him out for some fresh air—to a park or a ball game. Just keep him away from brick buildings.—**Gus Venditto**

Action Games from the East

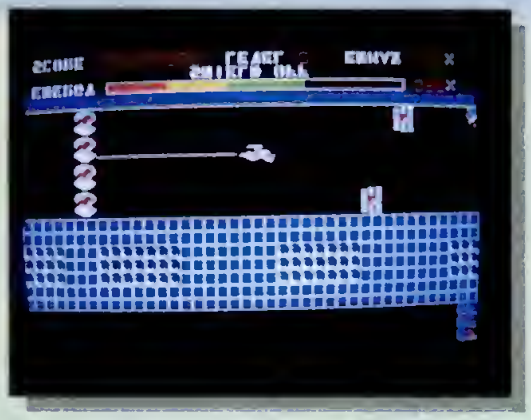
Software is fast becoming a global commodity. *Tetris* is just one of four games that Spectrum HoloByte is marketing in an international series, and Sierra On-Line, another American game designer/publisher, has imported a game called *Thexder* from Japan—where it has sold more than half a million copies.

Thexder is an arcade game; you are the pilot of a Thexder Super Assault Vehicle. Your mission is to explore 16 different worlds—a.k.a. mazes—while keeping a sharp eye out for various aliens that lurk around every bend. Taking a cue from Transformer toys, the game lets you change from robot to jet with the press of a key. Great sound and graphics.

Soko-Ban, a Japanese contribution distributed by Spectrum HoloByte, requires you to neatly and efficiently move boxes around a maze. It's similar to those "Chiclets" board games of the fifties and sixties—where one of the tiles of the puzzle was missing, and you had to slide the others around to form a pattern. But *Soko-Ban*, which means "warehouseman" in Japanese, is more difficult and challenging. You can only move a box by pushing it forward; thus careful planning is required lest you trap yourself in a corner. This game is said to be used as a training tool for Japanese laborers loading VCRs and automobiles aboard ships.—**Donald B. Trivette**



Soko-Ban is Japanese for "warehouseman"; push all the boxes into the storage room and you get to move up one level.



Flying the Thexder *vehicle and blasting away at Tribars, Baffins, and assorted Rimquarts in order to reach the central computer.*

List Price: *Soko-Ban*, $29.95.
Requires: 256K RAM; one floppy disk drive; VGA, EGA, or CGA; DOS 2.0 or later (joystick optional). Copy protected.
Spectrum HoloByte, 2061 Challenger Dr., Alameda, CA 94501; (415) 522-3584.

CIRCLE **656** ON READER SERVICE CARD

List Price: *Thexder*, $34.95.
Requires: 256K RAM; one floppy disk drive; VGA, EGA, or CGA; DOS 2.0 or later (joystick optional). Copy protected.
Sierra On-Line, P.O. Box 485, Coarsegold, CA 93614; (800) 344-7448, (209) 683-6858.

CIRCLE **655** ON READER SERVICE CARD

Is Tetris the First in a New Genre, the Action Puzzle?

When I first played *Tetris* I knew it was a winner. It was addicting, compelling, and fascinating in its sheer simplicity. It's almost like a real-time IQ test. Surely it's the Rubik's Cube of computer games. In fact, it may represent a new genre of computer game. Until now we've seen maze games, move-and-shoot games, adventure games, and even simulations such as *Star Trek*. This game is unlike them all. It's best described as an action puzzle. A time-consuming, baffling, irksome, and addicting killer action puzzle at that. My first night with the game had me up until 4 A.M. Highly recommended.
—**John C. Dvorak**

to make it more commercial. The screens were given glamorous backgrounds, and a small joke—or was it a political comment?—was added: the title screen shows the onion domes of the Kremlin, and then a small Piper Cub flies across Red Square trailing a banner. People who have seen the original program say it was developed using the PC's text-graphics characters, and that although it was in color, it lacked the snappy graphics we've come to expect in arcade games. We may be missing the original flavor, but Spectrum HoloByte pulled out all the stops in giving this game the features that game aficionados want: a boss key (Esc pops up a spreadsheet and pauses the game); separate on-disk versions for CGA, EGA, and Hercules graphics; a statistical monitor of the shapes seen per game; a memory-resident mode; and some stunning scenery (it has to be seen in EGA to be appreciated).

There are several skill levels, but I'm still working on the slowest and it is difficult to imagine anyone—in the East or West—who is able to coordinate his brain and fingers to play at the fastest speed for long. But there's more than enough challenge at the lower levels to keep you playing for hours, if not days, at a time.
List Price: *Tetris*, $29.95.
Requires: 256K RAM; one disk drive; DOS 2.0 or later (joystick optional); VGA, EGA, CGA, and memory-resident versions included. Copy protected.
Spectrum HoloByte, 2061 Challenger Dr., Alameda, CA 94501; (415) 522-3584.

CIRCLE **657** ON READER SERVICE CARD

AFTER HOURS

EDUCATION

Seeing Stars and Suns On a Color Monitor

BY EDWARD MENDELSON

The simplest way to decide which astronomy program to buy for your PC is to ask yourself whether you prefer traveling to faraway places or staying close to home.

Stay-at-homes should choose Spectrum HoloByte's $14.95 *Tellstar* ($29.95 for a version that uses a coprocessor). Although its sky charts include extensive coverage of distant galaxies as well as nearby stars, it only displays the sky as it appears from Earth.

Long-distance wanderers will prefer Interstel's $35 *Solarsim*. It lets you see what the sky looks like from any point on Earth or anyplace else in the solar system. You can even look down on the solar system from arbitrary points above and below it. When planning a trip, you can get a preview of the objects visible from Venus, or Halley's Comet, or any of your favorite resort asteroids.

The sky charts that *Solarsim* flashes on your PC planetarium aren't the most elegant, but they're packed with shining objects. In addition to 800 stars and a few galaxies, the program's database includes 200 asteroids and 60 comets, and you can add more.

Tellstar doesn't have all the options and objects of *Solarsim*, but it has a more elegant display. For some purposes, it may be more useful. Its charts display the sky as seen from any city. One touch of a cursor key shifts your viewing angle by 45 degrees, or you can switch instantly to an overhead view. *Tellstar* includes a hundred-plus "messier objects" and a display option lets you concentrate on only the beautiful galaxies.

But each of these programs is a reminder that no computer graphics, not even VGA, can begin to approach the brightness and resolution of the MSD—the Midnight Sky Display.

List Price: *Solarsim*, $35.
Requires: 128K RAM; CGA, EGA, or VGA; DOS 2.0 or later. Not copy protected. Interstel, P.O. Box 57825, Webster, TX 77598; (713) 333-3909.

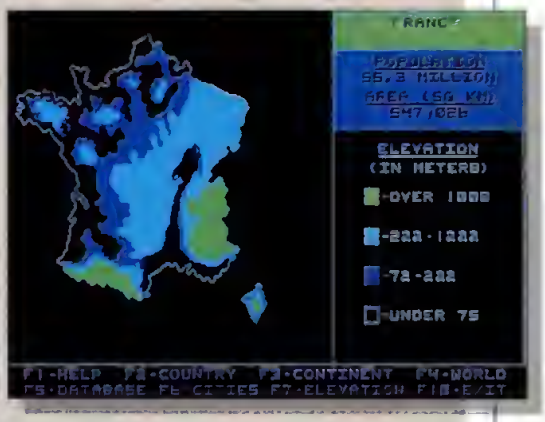
CIRCLE **654** ON READER SERVICE CARD

List Price: *Tellstar*, $29.95 for version using 8087 coprocessor; $14.95 for regular version.
Requires: 256K RAM; CGA, EGA, or VGA; DOS 2.0 or later. Not copy protected. Spectrum HoloByte, 2061 Challenger Dr., Alameda, CA 94501; (415) 522-3584.

CIRCLE **653** ON READER SERVICE CARD



Solarsim displays either star charts or views like this of the solar system in space. The small box at the upper right indicates the location of Jupiter.



PC-Globe maps can show elevations and major cities. There's a limited amount of statistical information in databases for each country.

EDUCATION

Geography Basics: PC-Globe Puts the Whole World in Your Hands

BY ILONA PRICE

PC-Globe, a $59.95 Atlas-like map program, gives you the opportunity to see the world using your PC.

The heart of the program is an extensive set of databases packed with an enormous amount of information about 177 different countries. Maps display major cities, elevation, population density, and other useful information.

Through *PC-Globe*'s commands, you can get pertinent statistics on everything from population growth and life expectancy to political organization and literacy rates.

PC-Globe presents much of this information in colorful, attractive bar graphs and pie charts that are suitable for high-school geography and economics classes, but would leave business users hungry for more. For instance, populations are broken down into only three age groups.

When you boot the program, you are greeted by a screen-size map of the world with point-and-shoot commands listed along the bottom of the screen. To locate a nation, you simply tap the F2 key, enter the name of the country, and it's highlighted in red on the orange map.

You can browse among the database entries for each country for whatever facts you want. Or you can select "cultural considerations" for a brief profile of a nation's demographics, economy, and customs.

Printer drivers for lasers are in the works and should be available by April, but at this point *PC-Globe* comes without printer drivers of any kind. That's an unfortunate omission, because users are limited to printing *PC-Globe* screens on dot matrix printers with DOS's PrtSc and Graphics commands.

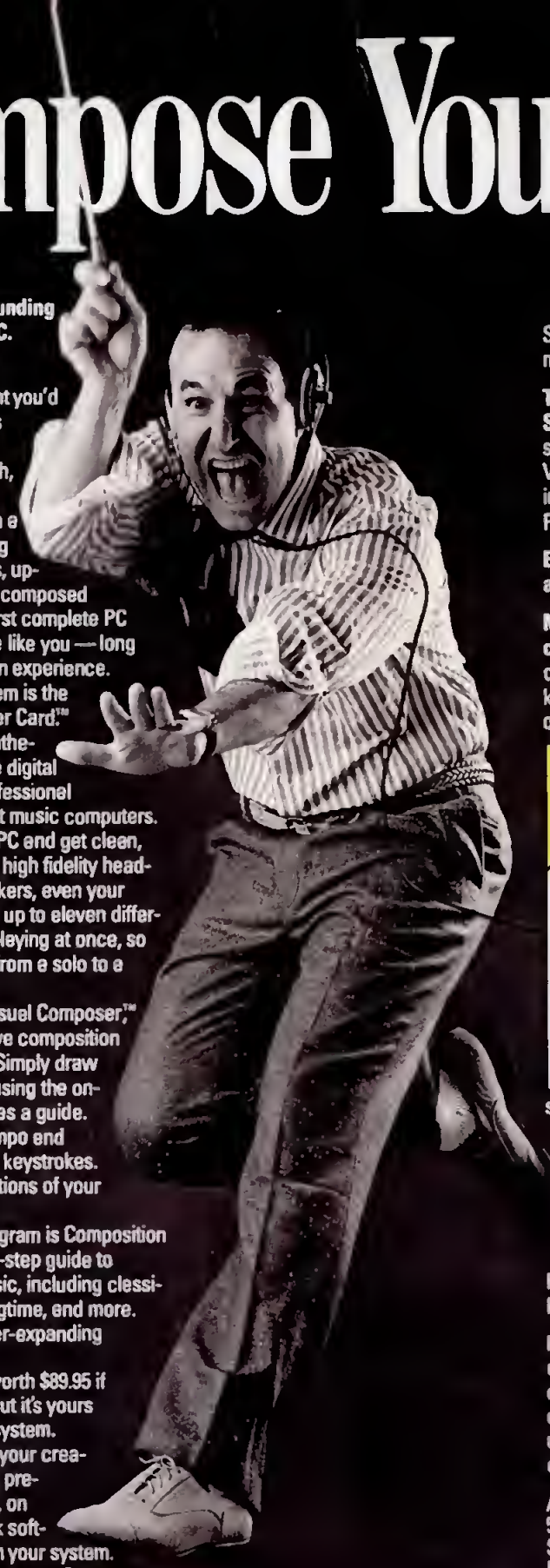
Its colorful graphics and ease of use may be just the hook to get students or casual users interested in geography and the world around us. But as a serious reference tool, *PC-Globe* takes a back seat to traditional atlases.

Comwell Systems plans to sell annual updates to keep *PC-Globe* accurate. The first update will appear in April.

List Price: *PC-Globe*, $59.95.
Requires: 256K RAM, CGA and EGA, DOS 2.0 or later. Not copy protected. Comwell Systems Inc., P.O. Box 41852, Phoenix, AZ 85080.

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Then play back all of your creations, as well as several pre-programmed selections, on the Juke Box™ playback software, also included with your system.

Look for the Ad Lib Personal Computer Music System™ at selected computer and music stores, or order direct from Ad Lib with your check, Visa or MasterCard.

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AFTER HOURS

EDUCATION

Stickybear Series Turns the Three Rs Into Fun and Games

BY EDWARD MENDELSON

PC Labs has never encountered a situation as serious as this. In our well-equipped, high-security evaluation area, we assigned an expert panel of 6-year-olds to test the Stickybear series of educational software. The problem? Now we can't get them to stop.

This series of $39.95 disks from Weekly Reader Software teaches reading, spelling, math, and typing. It also presents some of the most irresistibly silly animations available on any computer screen.

The star of the show is Stickybear, who needs a lot of help from his young friends. The more his playmates learn, the less often Stickybear gets dunked in a tub or suffers some other uncomfortable and humiliating fate—from which he always bounces back, however, ready for more.

In *Stickybear Spellgrabber*, for example, he has to run through a multilevel maze and pick up each of the letters of a word in the right order. He makes running jumps from one level of the maze to another when his friends push him in the right direction by pressing the cursor keys. But if their timing isn't right, Stickybear misses the opening and bangs his head on the ceiling. It isn't easy to get the timing right—and it's virtually impossible on a machine running faster than 6 MHz. Poor Stickybear.

In *Stickybear Math*, every time his young friends get the right answer to an addition and subtraction problem, Stickybear gets helped out of a sticky situation. Each correct sum piles up another block to rescue him from the trapeze he clutches in panic, or gives him one of the turtles he needs as stepping-stones across a river.

For thoroughly instructive silliness, nothing comes close to the fun and frolic to be found in *Stickybear Reading*. Our lab-coat-clad 6-year-olds are able to construct sentences like "The turtle jumps over the computer" and "The skunk bounces past the helicopter" and then see these sentences acted out in animated form. And whenever they spell a word correctly, they see the long-suffering Stickybear celebrate by running across the screen.

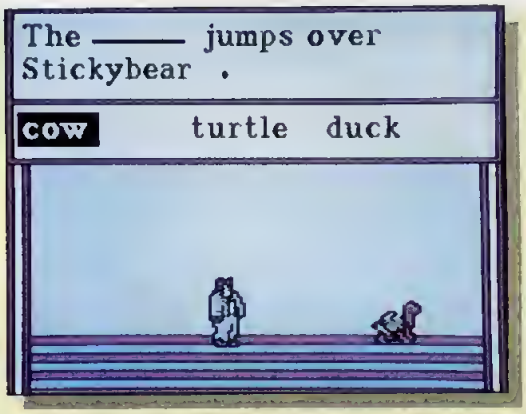
The designers of these programs seem to enjoy humiliating innocent bears just as much as young users do. In one game, each wrong answer removes one of a stack of platforms that holds Stickybear high above a swimming pool, until, after one wrong answer too many, he hits the water with a resounding splash.

But the designers didn't build in graphics that exploit the extra detail of EGA or VGA boards. And, because the programs don't compensate for the extra speed of AT or PS/2 machines, a few of the games run too quickly for most children to solve.

Each game in the series can be adjusted to fit the skill level of the players. According to the packages, the suitable ages range from 5 through 9. But, judging from the people in the lab who have been trying to get these games out of the hands of our 6-year-old technicians so that they can dunk Stickybear themselves, the true age range of the series seems to be more like 25 to 90.

List Price: *Stickybear Math, Math 2, Numbers, Parts of Speech, Reading, Reading Comprehension, Spellgrabber,* and *Typing*, $39.95 each **Requires:** 256K RAM, one disk drive, CGA, DOS 2.0 or later. Copy protected. Weekly Reader Software, 10 Station Pl., Norfolk, CT 06058; (800) 327-1473, (203) 542-5553.

CIRCLE **658** ON READER SERVICE CARD



Stickybear Spellgrabber *uses a game very much like* Lode Runner *to encourage kids to learn spelling.*

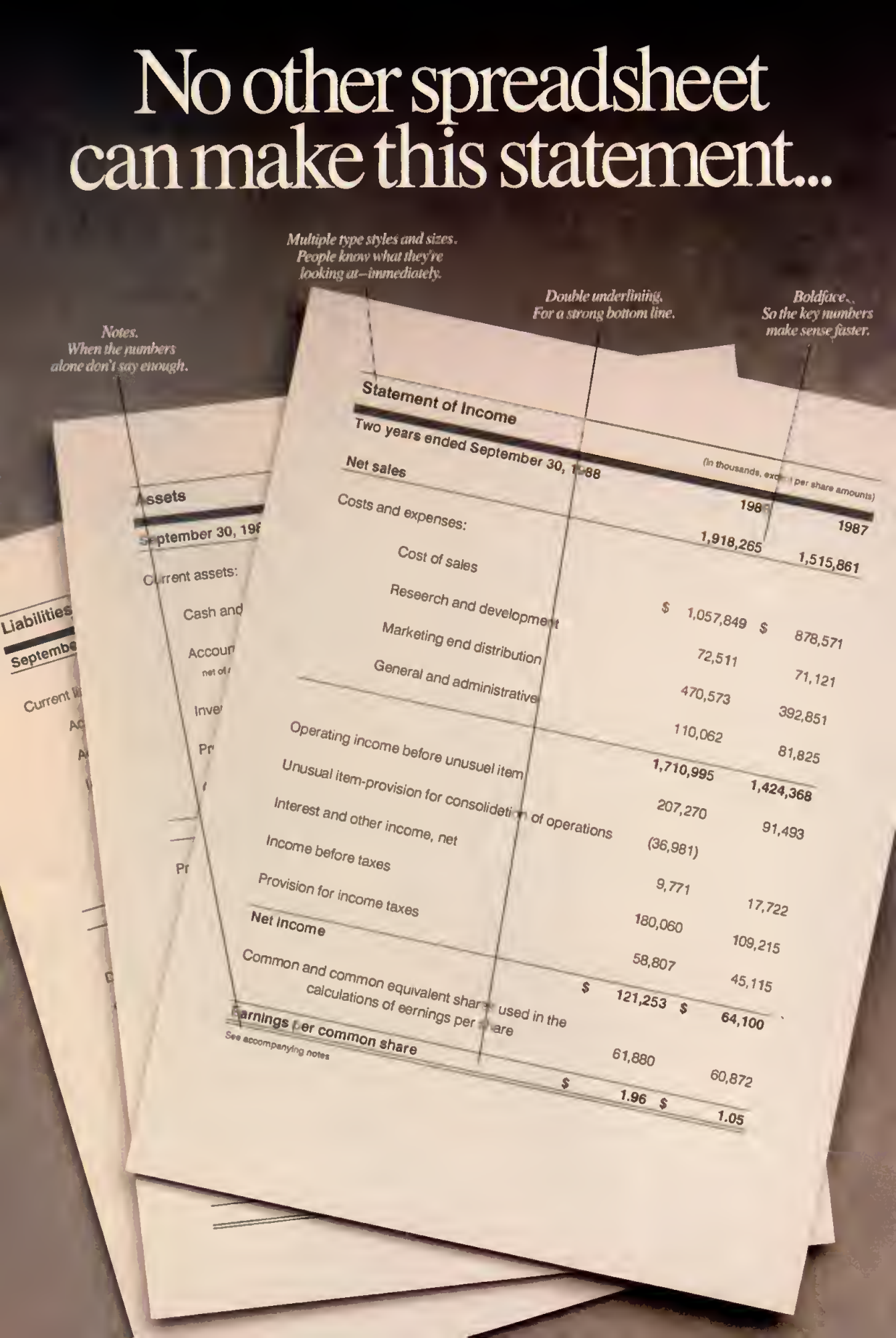


Kids can play with tangible Stickybear *toys when the computer's off. decals, a poster, and a picture book come with the software.*

AFTER HOURS INDEX

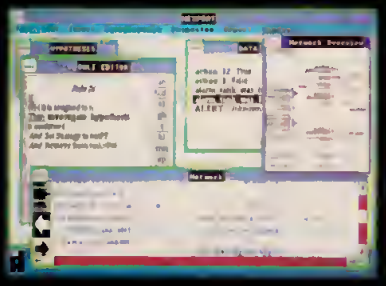
Tellstar and **Solarsim**
Two ways to look at the stars
PC-Globe
Some help with geography homework
Tetris
An original and habit-forming game from the Soviet Union

No other spreadsheet can make this statement...

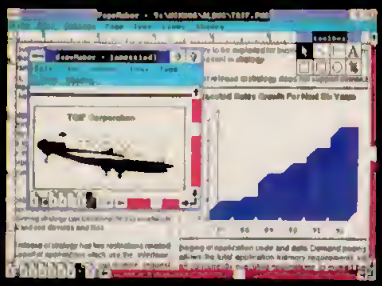


Applications keep pouring in for the Windows

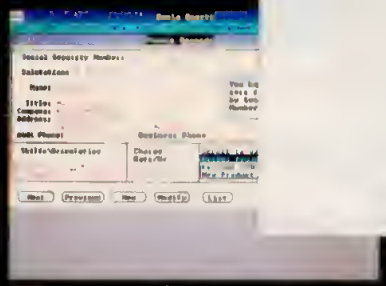
PC MAG LIBRARY



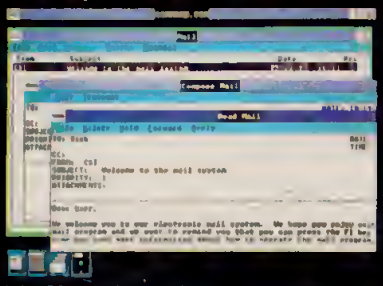
Nexpert Object, AI graphical expert system application, Neuron Data.



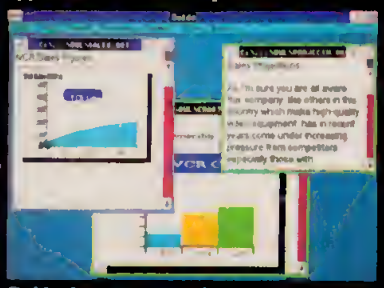
PageMaker,® desktop publishing application, Aldus Corporation.



Omnis™ QUARTZ,™ multi-user database application, Blyth Software, Inc.



The Network Courier,® electronic mail application, Consumers Software, Inc.



Guide, hypertext application, OWL International, Inc.



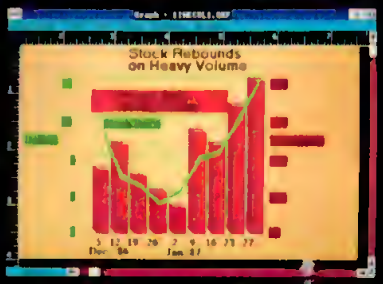
Windows DRAW,™ presentation graphics application, Micrografx, Inc.



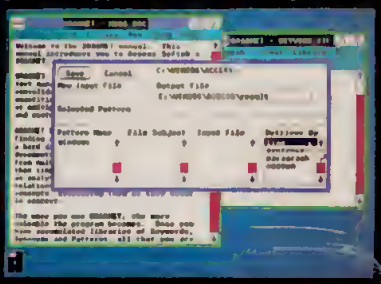
PC Paintbrush,® color design and graphics application, ZSoft Corporation.



ClickStart!, applications organizer application, hDC Computer Corporation.



Windows GRAPH,™ business graphics/charting application, Micrografx, Inc.



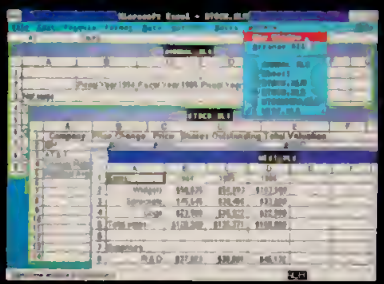
Dragnet, text retrieval application, Access Softek.



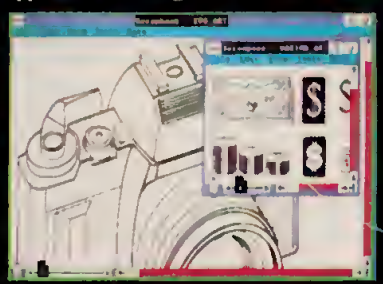
In*a*Vision,™ intermediate CAD application, Micrografx, Inc.



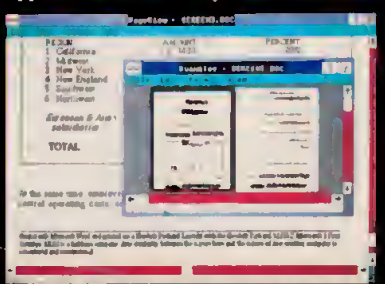
Windows Mail, electronic mail application, DaVinci Systems.



Microsoft Excel, spreadsheet application, Microsoft Corporation.



Scrapbook, art images application, T/Maker Company.



Microsoft Pageview, page preview/graphics integration for Microsoft Word.

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